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Nutrition Knowledge and Child Care Feeding Practices of Early Childhood Education Students: A Preliminary Study

Sarah Jill White
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To the Graduate Council:

I am submitting herewith a thesis written by Sarah Jill White entitled "Nutrition Knowledge and Child Care Feeding Practices of Early Childhood Education Students: A Preliminary Study." I have examined the final electronic copy of this thesis for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Science, with a major in Nutrition.

Melissa B. Hansen-Petrik, Major Professor

We have read this thesis and recommend its acceptance:

Katherine Kavanagh, Sean Durham

Accepted for the Council:
Dixie L. Thompson

Vice Provost and Dean of the Graduate School

(Original signatures are on file with official student records.)

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Nutrition Knowledge and Child Care Feeding Practices of Early Childhood Education Students: A Preliminary Study

A Thesis
Presented for
the Master of Science Degree
The University of Tennessee, Knoxville

Sarah Jill White
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Abstract

The purpose of this study was to describe the nutrition knowledge and child care feeding practices of Early Childhood Education students in a university setting. Thirty-three Early Childhood Education students from seven geographically diverse universities completed a web-based survey assessing nutrition knowledge and child feeding practices. A nutrition knowledge instrument was developed and validated to measure knowledge of nutrition for preschool-aged children. The Comprehensive Feeding Practices Questionnaire, which has been previously validated in parents, was slightly modified and used to assess child feeding practices. Mean scores for the nutrition knowledge and child feeding practices were determined. Multivariate analyses were conducted to determine differences in mean nutrition knowledge and feeding practices scores across sample characteristics. Early Childhood Education students were found to have more knowledge of MyPyramid food groups and dietary sources of nutrients than dietary intake recommendations for preschool-aged children. Students who had completed a college-level nutrition course scored higher on MyPyramid food groups and food sources of nutrients than those who had not, although these differences were not statistically significant. A nonsignificant trend was observed in knowledge of dietary recommendations according to practicum status. Additionally, students who had not started a practicum reported using food as a reward significantly more than students who had completed a practicum. Results suggest roles for both nutrition coursework and practicum training in optimizing nutrition knowledge and child feeding practices among future leaders in early childhood education. Further research is needed to more clearly identify nutrition knowledge and child feeding practices in this population.

Preface

To assist the reader, an explanation of the format used for this thesis follows. This thesis consists of two parts. Part I includes an introduction, an extensive review of literature, and the study's research questions. Part II includes a manuscript containing introduction, methods, results, and discussion sections related to the research.

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Introduction

The prevalence of childhood obesity in the United States has prompted researchers to investigate the genetic and environmental risk factors that contribute to the disease. The feeding environment of young children may be one such risk factor that contributes to childhood overweight and obesity. Not only are parents and the home environment influential in shaping the feeding behaviors of preschool-aged children, but early childhood educators and the child care environment also have great potential to influence the development of preschoolers' eating behaviors. Thus, the current study sought to describe the nutrition knowledge and child care feeding practices of Early Childhood Education students enrolled in universities throughout the United States.

Part I

Overview

Abstract

In the United States, childhood obesity rates have nearly tripled within the past three decades (1). Given that obese children have a higher risk of developing type 2 diabetes, hypertension, hyperlipidemia, and several of the leading causes of morbidity and mortality in the U.S. (2), it is of great significance to identify potential risk factors that contribute to obesity. Understanding the risk factors that contribute to the disease may lead toward effective implementation of interventions and policies that aid in childhood obesity prevention.

The feeding environment of young children may be a risk factor contributing to childhood overweight and obesity. While the role of parents and their influence on the feeding environment and the dietary intake of young children have been well investigated (3-37), less research has been conducted on the roles of early childhood educators and the child care environment on the development of child eating behaviors (38-44). This is particularly important because a majority of preschool-aged children are in non-parental care (45). Early Childhood Education students are an extremely important population to explore given their likelihood of becoming future leaders and policy makers in early childhood education (46). Adequate nutrition knowledge and optimal child feeding practices are imperative for developing policies and feeding environments that promote positive eating habits and behaviors in children. Therefore, the purpose of this study was to describe the nutrition knowledge and child care feeding practices of Early Childhood Education students from geographically diverse university settings.

Review of Literature

Childhood Overweight and Obesity

Childhood obesity rates have nearly tripled within the past three decades (1). Specifically, 11.9% of children aged two through nineteen years at or above the 97th percentile of the body mass index-for-age growth charts in 2007-2008 (47). Furthermore, 16.9% of children within this same age group were at or above the 95th percentile, and 31.7% were at or above the 85th percentile (47). Therefore, determining the factors that contribute to this epidemic and that may be modifiable is paramount. Currently, body mass index (BMI) percentile for a child's gender and age group is used to classify weight status among children (48). A healthy weight is defined as a BMI from the 5th to less than the 85th percentile, whereas children with a BMI from the 85th to less than the 95th percentile are categorized as overweight. Obese children are defined as those who have BMIs that are greater than or equal to the 95th percentile for their age and gender group (48). These classifications have been modified from the previous categories of at risk for overweight (BMI of 85th to less than 95th percentiles) and overweight (BMI at or about the 95th percentile) (49). Evidence shows that obese children have a higher risk of type 2 diabetes, hypertension, and hyperlipidemia than their non-obese counterparts (2). Due to the detrimental effects and prevalence of childhood obesity, it is of utmost importance to examine the risk factors, especially those that can be modified. Identifying the determinants of obesity would allow the development of targeted interventions to slow the progression of the disease.

Food patterns and behaviors established during the early years of life tend to persist into adolescence and adulthood (50-51). Thus, early dietary behaviors may initiate the progression toward overweight and obesity in later childhood and into adulthood. Research has begun to focus on this critical stage of life, especially focusing on the role of parents and other early

environmental influences on child eating patterns, behaviors, and dietary intake (3-37). If the feeding environment of young children largely incorporates parents and other family members, then possible modifiable risk factors contributing to obesity may occur within this context. The role of the child care environment and child care providers in development of dietary intake and behaviors is only beginning to be investigated (38-44). The role of parents and family has been more thoroughly studied and examination of findings in this area provides an important basis for investigations into the roles of early childhood educators and child care providers.

Parental Influence on Child Eating Patterns, Behaviors, and Dietary Intake

Throughout the early years of a child's life, an enormous amount of cognitive and physical development occurs (52). These years are critical periods for learning (52). Because young children generally spend the majority of their time with parents and caregivers, the environment created by the parent or guardian is crucial to the development of the child (53). Specifically, parents' actions and decisions greatly determine the child's feeding environment. When children are very young, they learn how to eat, when to eat, what foods to eat, and how much of the foods to eat. These behaviors are largely determined by the primary environment surrounding the child, which in most cases is the family environment (53). Furthermore, not only do feeding behaviors affect the young child, but evidence also suggests that child feeding behaviors and habits established during the early years of life continue into later stages of life (50-51). A study by Branen and Fletcher (50) assessed the eating habits of college students and the recollections of their feeding practices as children. The results of this study suggest that eating patterns established in childhood continue into late adolescence. Therefore, parents have

the ability to positively shape the child's external feeding environment, which can then set the stage for healthy lifelong eating patterns (50).

Parents influence their child's eating patterns and behaviors in a multitude of ways. Parents use specific feeding styles, prepare foods, structure meals, model feeding behaviors and dietary intake, make food available and accessible, oversee the social context of family meals, and have various knowledge and beliefs about nutrition. These all work together to shape the eating habits and behaviors of the child.

Parental Feeding Styles

The dimensions of parental feeding styles have been developed from the general parenting styles used by parents in raising their children (54). The two broad dimensions of parenting styles can be summarized as demandingness and responsiveness. For general parenting, demandingness refers to parental control, whereas responsiveness refers to warmth in relating to the child (54). From these two overall dimensions, classifications of general parenting can be made based on the degree of parental demandingness and responsiveness. The general parenting styles are categorized as authoritarian, authoritative, and permissive (54). These styles can be defined by the amount of parental control versus the amount of child control within the parent-child relationship: authoritarian style is characterized by high demandingness and control and low responsiveness; authoritative parenting style is referred to as high demandingness and responsiveness; permissive style is distinguished by low demandingness and responsiveness. Similarly, these three general parenting styles are used to describe parents' feeding styles.

Parental Feeding Styles, Child Dietary Intake, and Food Preference

Parental feeding styles have the ability to influence the child's dietary intake and food preferences (3-7). In a study performed by Hoerr et al (3), the parental feeding styles and child's evening food intake was evaluated for 715 low-income children and their parents participating in Head Start. The Caregiver's Feeding Styles Questionnaire (4) was used to assess parental feeding styles, while dietary recalls allowed for evaluation of child food intake. The use of permissive feeding styles was negatively associated with intake of fruits, vegetables, and dairy foods. In contrast, parental use of authoritarian feeding styles was associated with higher intakes of fruits, vegetables, and dairy. The dietary intake of fruits, vegetable and dairy among children with parents who used authoritative feeding style fell between the intakes of children with permissive parents and those with authoritarian parents (3). In contrast, other studies have found authoritative feeding styles to have a positive association with dietary intake and encouraging healthy eating (5-7). Zeinstra and colleagues (5) also assessed the relationship between parental feeding styles and child fruit and vegetable intake. Two hundred and fifty-nine children and their parents from primary schools in the Netherlands were surveyed about feeding styles and dietary intake. The parental decision to give the child a "choice" was positively related to child's fruit and vegetable intake. Giving children a choice would most likely be associated with the authoritative feeding style since parents control consumption by only presenting certain foods to the child, while exhibiting responsiveness by allowing the child to make an autonomous decision (5). Altogether, specific parental feeding styles may positively or negatively impact children's consumption of healthful foods.

Parental Feeding Styles and Child Weight

Along with the influence of parental feeding styles on the dietary intake of children, parental feeding styles may also be related to the child's weight or body mass index (BMI) (4, 8). A study on the relationship between parental feeding styles and child's BMI showed that the permissive feeding style was significantly associated with higher child BMI, even after controlling for confounders such as child temperament, parent effect, ethnicity, child age, and parent BMI (8). These results are consistent with findings by Hughes et al (4) confirming that children of permissive parents had higher BMI z scores than children of authoritarian and authoritative parents. Additionally, Moens et al (9) observed that the permissive feeding style was the most common among parents of overweight children. This study included observations and self-reports of family meal functioning in parents with overweight children and also in parents of normal weight children. Not only did they find a high prevalence of permissive feeding styles in parents of overweight children, but the researchers also reported that demandingness and control strategies were two times as prevalent in parents with overweight children, whereas responsiveness was not used as often (9). These results suggest that the unequal use of demandingness and responsiveness may contribute to the development of inappropriate child eating patterns, thus potentially leading to weight gain. However, not all results are consistent between parental feeding styles and child's BMI (10-12). Nonetheless, current research suggests that children need some guidance, control, and responsiveness to develop healthy and appropriate feeding behaviors and eating patterns. Further research needs to assess the relationships between parenting styles, child eating, and child weight for the development of effective parental feeding interventions and the possible modification of risk factors for obesity.

Furthermore, there is potential for parental feeding styles to greatly diminish the child's ability to self-regulate energy intake. Evidence shows the presence of self-regulation in younger children, and then, as the child ages, environmental factors, such as parental feeding styles, become more influential (53-56). In a study performed by Fox et al (54), data from 24-hour recalls of a national random sample of 3,022 infants and toddlers living in the United States were analyzed. Results displayed a significant negative association between the number of eating times throughout the day and portion size consumed. Additionally, for children younger than eleven months, a significant negative association was found between energy density and portion size. However, this association was not found in toddlers. Therefore, these results verify the ability of infants and young toddlers to self-regulate energy intake. Although, this is an ability which may begin to slow or disappear as young children reach the toddler age (54). Overall, parental feeding styles can affect the feeding behavior and energy regulation in children.

Parental Feeding Styles: Restriction and Pressure

The parental feeding dimension of demandingness can also be divided into two separate feeding styles: restriction and pressure. Birch et al (56) highlighted these two critical strategies used in parental control in developing the Child Feeding Questionnaire (CFQ). This validated instrument assesses parental perceptions of responsibilities and child weight status as well as the use of specific feeding strategies such as restriction, pressure, and monitoring (56). A good amount of research has been conducted on the use of parental restriction of high fat, high sugar foods and pressure to eat fruits and vegetables within the context of child feeding (13-17). Consistent use of parental restriction and pressure within the child feeding environment has been

shown to have various effects. In a study comparing the use of feeding control in mothers of middle-class families and mothers of lower class families, the greater use of maternal control was associated with more appropriate dietary intake in children (13). In another study (14), the use of parental restriction was associated with an increased intake of nutrient-dense foods and a lower intake of energy-dense foods. In contrast, other evidence points to the negative effects of parental restriction and pressure on child eating patterns and behaviors (15-18). Fisher and Birch (15) performed a study investigating 197 young girls' intake of freely available palatable snack foods immediately following a meal. Additionally, a self-evaluation of the girls' eating and assessment of parental restriction was conducted. Results showed a positive association between parental restrictions of palatable foods and girls' intake of restricted foods when freely available. Furthermore, the findings revealed the young girls' displayed negative feelings toward their consumption of restricted foods. These outcomes suggest that restricting certain foods may contribute to eating in the absence of hunger when previously restricted foods become freely available (15). Consistent with these findings, other studies confirm the parental restriction of foods that should be limited within the child's diet contribute to an increased desire for the restricted food (16-17). A longitudinal investigation further evaluated the use of maternal feeding restriction on girls' tendency to eat in the absence of hunger (17). Findings revealed that between the ages of five to nine years, eating in the absence of hunger increased. In addition, overweight girls with parents who reported using more restrictive feeding practices at age five were found to consume more food in the absence of hunger at age seven and nine (17). Thus, the authors conclude that the use of restrictive feeding practices may pose adverse effects on the child's feeding behaviors, specifically on the child's energy balance. Unbalanced energy intake and expenditure can potentially lead to an increased risk of child overweight and obesity.

In the same way, research shows that the use of parental pressure as a feeding strategy has the ability to influence the development of child eating patterns (18-21, 56). An experimental study conducted by Galloway et al (18) examined the effects of parental pressure on child food intake. The authors aimed to determine whether the use of pressure would negatively affect the intake and child's response to the food. A repeated-measures, within-group experimental design was used to assess the effects of pressure and the absence of pressure on children during a meal. The outcomes showed that pressure negatively affected the intake of food, thus lowering food consumption, and it also elicited more negative responses from children. In addition, parents who reported pressuring their child to eat had children with significantly lower BMI scores. Altogether, this study supports the hypothesis that parental pressure to eat is not an effective practice in developing appropriate dietary intake in children and positive responses to food (18).

In other studies investigating the effects of parental pressure on child eating behaviors, similar results were found (19-21). Powers et al (19) concluded that within a population of low-income African-American preschoolers and their mothers, pressuring children to eat was negatively associated with child BMI. Thus, children who were reported being pressured to eat had lower BMI z scores than children whose parents reported not using pressure during feeding. These results suggest that mothers of children who weigh less possibly use more pressure to get their child to eat as compared to mothers with normal weight or overweight children (19). Correspondingly, research within a population of Mexican-American mothers and children confirmed that parental use of pressure during feeding was strongly associated with lower BMI in children (20). Overall, these studies have found an association between parental use of pressure in getting children to eat and the child's weight. However, the direction of this

relationship is complex (20). Are mothers pressuring their children to eat because they perceived them as being underweight or does the pressuring strategy itself decrease the child's dietary intake, thus contributing to lower BMI? Further research is needed to determine the causal pathways between parental pressure, restriction, and child weight status.

Parental Modeling and Food Availability

Researchers have used numerous methods to examine the impact that parental modeling and food availability have on child intake and preference. Parental modeling is especially vital for the child's learning that occurs through the observation of their surrounding environment. Modeling and food availability play an integral role in influencing the foods that children most regularly consume and come to prefer (22-24). Both modeling and availability will be discussed together since parents usually make foods available in the home if they regularly eat those foods (22). Evidence suggests that parents can use modeling to influence their child's dietary intake (25-26). Fisher et al (25) show parental modeling to be the best strategy for the encouragement of fruit and vegetable consumption in young girls. Parent consumption of fruits and vegetables was positively associated with girls' consumption of fruits and vegetables. Higher child fruit and vegetable consumption was associated with an increased micronutrient intake and lower fat intake in these children. Additionally, the use of parental pressure to eat fruits and vegetables was negatively associated with the girls' consumption. Interestingly, parents with lower fruit and vegetable intakes reported using more pressure to get their child to consume fruits and vegetables. Thus, instead of pressuring children to eat more healthful foods, parental intake of fruits and vegetables may be more beneficial for both parents and children (25). Similarly, the

dietary intake and eating patterns of overweight children was found to be influenced by their mother's intake (26) in an experimental trial assessing the amount of food consumed after receiving a preload. This study further validates findings that children eat similarly to their parents, thus providing additional support for the impact of parental modeling.

Taking a further look into the frequency with which parents model healthy eating behaviors and their own eating habits, Tibbs et al (27) conducted an evaluation of the relationship between parental modeling, eating patterns, and dietary intake of parents among 456 African-American parents. The frequency with which parents use modeling as a child feeding strategy was assessed by the Parental Dietary Modeling Scale. This instrument was developed for this study to specifically measure the use of parental modeling. Additionally, data on parental eating patterns and dietary intake were gathered using eating patterns and food frequency questionnaires. Results revealed that parents who reported frequently using modeling to positively influence the dietary behaviors of their children had lower dietary fat intake and higher fruit and vegetable consumption. These outcomes suggest that the frequency with which parents deliberately model healthy eating behaviors for their children may be associated with the parents' own dietary behaviors and intake (27). Thus, it is possible that parents' dietary intakes influence their purposeful use of modeling as a means to develop healthy eating patterns in their children. As mentioned, Fisher et al (25) found that parents with less healthful diets reported using more pressure to get their children to eat. Thus, it is possible that parents consciously shift to other parental feeding strategies to influence their children to consume more healthful foods when their own diets may not meet dietary intake recommendations. More research in parental use of modeling and parent dietary intake may give further insight into this relationship.

Along with the impact of parental modeling on children's dietary intake, modeling has been shown to be related to children's food preferences via parental food preferences (22-23). A longitudinal study including 70 children and their mothers was conducted to identify predictors of child food preferences (22). The number of years the child preferred a food, food neophobia, and mothers' food preferences were found to be factors that predicted child food preferences. Mothers' food preferences were positively associated with child food preferences for foods that were preferred, not preferred, and never tried. Hence, foods that the mothers preferred, and thus ate themselves, influenced the preferences and consumption of similar foods in children through modeling and food availability. An association was found between foods that had never been tried by the mother and the child, therefore suggesting that mothers do not give or make foods available to their children when they do not prefer the food. Overall, foods that mothers prefer are more likely to be modeled and made available to the child, thus greatly shaping the child's food preferences (22). However, contrasting results have been found regarding the impact that parental food preferences have on child preferences. A study by Borah-Giddens and colleagues (28) reported that parental food preferences are a minute predictor of child food preferences. Although findings are not completely consistent, it is vital to recognize that parents, who are often the primary providers for the child, are likely to determine what foods will be served and made available to the child. Thus, the foods that are served most often will be consumed most often, especially if the child is too young to prepare food.

Research has also shown that exposure to foods plays a role in child food preference (29-31). A randomized controlled trial was performed to evaluate the effectiveness of vegetable exposure on children's preference for previously disliked vegetables (29). Parents of children in the exposure group allowed their children to have a very small taste of the vegetable for fourteen

consecutive days. Compared to the control group and a group that received a pamphlet regarding child fruit and vegetable consumption, children who were continuously exposed to the vegetable displayed a significant increase in liking, ranking, and intake (29). These results were consistent with earlier research that suggested an increased exposure of about ten to fifteen times would increase the child's liking for a food (30). Such exposure strategies could be implemented by parents to increase their child's liking of fruits and vegetables without the use of restriction and pressure to eat (29). However, this study did not involve a follow-up to assess the continuation of the child's liking of the vegetable. Thus, questions remain about the long-term effectiveness of this strategy as the child develops and ages.

Aside from the repeated exposure of foods, the associations between parental modeling, food availability, and child weight were also investigated (20). Researchers collected information regarding demographics and child height and weight of 108 Mexican-American children and their mothers. Dietary intake and parental feeding strategies were also assessed using 24-hour dietary recalls and the Child Feeding Questionnaire, respectively. The findings revealed that parental modeling of healthy foods was associated with lower child BMI and energy intake in food-secure households. This relationship, however, was not found to be true in food-insecure families. High availability of healthy foods was associated with lower child BMI in food-insecure households only (20). Therefore, these outcomes suggest that the impact of parent feeding practices such as the modeling of healthy dietary behaviors or making nutrient-dense foods available to children may be different in food-secure and food-insecure households. Nonetheless, the impact of both modeling and food availability still remains evident, even though the degree to which they influence child eating behaviors, intake, and weight may vary.

Meal Structure, Social Context, and Preparation

Given that parents of young children are responsible for the feeding and nourishment of their children, they also determine the structure, social context, and preparation of meals. Parents decide when to feed the child, the number of meals or snacks the child consumes, who eats with the child, and how the foods are prepared. Meal structure and frequency of food consumption are important in teaching the child when foods are regularly consumed as well as enhancing the child's overall dietary intake. For example, the consumption of breakfast has been shown to positively impact the dietary quality of children (32) and to be negatively correlated to weight in preschoolers (33). Thus, parents must decide when to feed their child and the frequency of meal occurrence. Additionally, the context in which meals are consumed can have an effect on the developing feeding behaviors of the child. Meals consumed as a family and with other people have been shown to increase the diet quality of children (34-35). Furthermore, the positive or negative mealtime environment may affect the child's preferences for certain foods. As mentioned, parents creating a negative environment by pressuring the child to eat certain foods may potentially reduce the child's preference for the food (18), whereas a positive and encouraging environment may be helpful in establishing appropriate food preferences.

The manner in which foods are prepared is also dependent upon the parent since they prepare or buy foods that are served to their child. To increase the child's consumption of healthy, lower-fat foods, parents must be knowledgeable about the basics of nutrition and food preparation. It may also be beneficial to engage children in conversation about the nutritious value of healthy foods during meal preparation (36). In all, parents have a powerful role in

shaping their child's eating habits by determining meal structure, social context, and methods of food preparation.

Parental Nutrition Knowledge and Beliefs

The nutrition knowledge and beliefs of parents may also potentially influence the child's dietary behaviors and intake. In a study evaluating the nutrition knowledge, beliefs, and intake of ninety-two children and their mothers, researchers found that children's nutrition knowledge was related to the knowledge level of their mothers (37). Additionally, the nutrition knowledge of mothers was positively associated with child fruit intake. In contrast, child vegetable and sugar consumption were not related to the mothers' knowledge. These results suggest that mothers are teaching their nutrition knowledge to their children through various practices such as discussion or modeling. However, the mothers' nutrition knowledge alone may not be a significant predictor of child fruit and vegetable intake (37). Nevertheless, parent nutrition knowledge may result in certain deliberate actions such as modeling the consumption of healthful foods in appropriate amounts, making nutrient-rich foods available to the child, and preparing foods in a healthy way.

Overall, parents play a multifaceted role in shaping and influencing their child's eating patterns, behaviors, and dietary intake. To summarize, their role includes the use of specific feeding styles, preparing foods, structuring meals, modeling dietary behaviors and intake, making food available and accessible, and directing the social context of meals. Many young children, however, may additionally be exposed to non-parental caregivers who also have the

potential to influence the development of dietary habits. As research on the role of non-parental caregivers in influencing development of dietary habits is limited, examining what is known of the parental role provides an important basis for beginning such examination.

Children in Child Care across the United States

Over the past three decades, the percentage of mothers in the labor force with children six years and younger has risen from just under 40% to 63.5% in 2006 (58). As a result, young children are spending less time under the care of their parents and are receiving other forms of child care. In 2005, approximately 12 million U.S. children under the age of six regularly participated in various types of child care other than parental care (45). Specifically, 74% of children aged three to six years old are involved in child care situations that exclude parental care and 57% of these children are in center-based child care facilities (59). On average, preschoolers spend approximately thirty-six hours per week in child care situations apart from their parents (60). Given these substantial child care participation rates, the child care environment is stepping in alongside the family setting to provide early experiences that may shape and impact the social, emotional, and cognitive development of young children (61).

The Impact of Child Care and Early Education on Young Children

As child care participation rates in the United States continue to increase, child care and early education experiences are positioned to play a more influential role in impacting children's development (62). Thus, it is important to consider the academic, social, and health outcomes of children who have participated in early child care programs in order to determine areas in which

child care may be beneficial to children's growth, development, and learning as well as areas that may need improvement.

To examine the academic and developmental benefits of child care, the National Institute of Child Health and Human Development (62) conducted a longitudinal study that followed over 1,000 children from birth to 4 ½ years. The children's cognitive, language, and social skills were assessed at 4 ½ years. These skills were examined in relation to the quality, quantity, and type of child care that the children attended. Results showed that higher quality child care was associated with increased cognitive and language abilities. Specifically, children who attended child care centers had more advanced language and memory skills compared to children who did not attend centers. However, children who spent more time in child care had additional problem behaviors compared to children who spent less time in child care. Therefore, these findings displayed both advantages and disadvantages associated with child care. High-quality child care may be beneficial to children's development of academic skills, whereas the amount of time children spend in child care may have adverse effects on the children's social skills and thus increase problem behaviors (62).

In addition to these findings, multiple studies have reported a positive correlation between the quality of child care and preschooler's cognitive and social development after adjusting for family characteristics (62, 64-69). Positive associations have also been found between child care quality and children's cognitive skills during elementary school (70-71). Quality of care refers to care that cultivates positive relationships, creates environments that inspire children to learn, and provides for the safety and health of children (63). Therefore, the short- and long-term developmental impacts resulting from experiences in the child care setting may depend on the quality of the care the child receives (63). While numerous factors such as

child care providers' education, classroom characteristics, curriculum types, child and provider interactions, or program characteristics may contribute to the quality of a child care program, there is no single indicator of quality (63, 72-74). Overall, these findings suggest that young children's cognitive and social development have the potential to be impacted by their experiences in early education and child care programs. Furthermore, children's development and learning may be enhanced with a higher quality of care.

Child Care and Provider Influence on Child Eating Patterns, Behaviors, and Dietary Intake

Similar to the way that child care may impact children's cognitive and social development, the mealtime experiences in the child care setting have the potential to impact the development of eating behaviors in young children. For example, if meals are provided by the center, then the foods made available to the attending children may shape their dietary behaviors and preferences. Moreover, child care providers have great potential to impact the eating patterns and behaviors of children in several ways similar to the impact of parents. Within the child care environment, it can be assumed that providers exert certain feeding styles during mealtime, model feeding behaviors and dietary intake, establish the social context of meals, and have nutrition knowledge and beliefs of their own. Due to the large amount of time children now spend in non-parental care, the responsibility of promoting development of appropriate child eating patterns, behaviors, and dietary intake needfully includes not only the parents, but also the child care providers. Although the role of parents remains vital, child care providers may be gaining importance in shaping the role of the development of feeding behaviors in children (75). In all, the child care experiences that children have during the early years of life may play an influential role in their development, learning, and behaviors.

Meals in the Child Care Setting

U.S. child care centers are regulated by the state in which the center is located (76). Currently, there are no national quality standards that child care centers must meet (76). Thus, health and safety standards differ from state to state (77). Consequently, policies regarding nutrition and meals in child care centers vary among individual states (76).

In 2009, Kaphingst et al (78) examined each U.S. state's child care licensing regulations regarding nutrition. Content analyses were conducted for each state's licensing regulations for child care centers, small family child care homes, and large family child care homes. Results showed that child care centers were more tightly regulated compared to small and large family child care homes. Twenty-nine states required child care centers to abide by the Child and Adult Care Food Program (CACFP) standards or standards that were similar. The CACFP provides funds for the meals of children in organizations such as child care centers, and nutritional standards for the organizations receiving funds have been set by the CACFP (79). Nineteen states had specific standards for the number of meals and snacks to be provided by child care centers based on the amount of time children spend in the center. Only two states, Michigan and West Virginia, mandated that foods provided by child care centers must follow the nutrient recommendations in the 2005 Dietary Guidelines for Americans (78). In addition, twelve states had policies that prohibited centers from serving certain foods of low nutritional quality. Detailed nutritional standards such as maximum values of total calories or fat were not indicated by any state. Furthermore, vending machine use by children was prohibited by three states: Alabama, Georgia, and Louisiana (78). Thus, the most recurrent state regulation regarding meals in child care centers was that meal requirements must be structured based on the CACFP

standards or other similar standards. Overall, approximately 60% of states had some regulations regarding meal requirements (78).

In 1978, the Child and Adult Care Food Program (CACFP) originated and began distributing funds for the meals of children in organizations such as child care centers as well as homeless shelters (80). The CACFP funds also provide for the meals of children who attend Head Start, a national school readiness program that provides academic, health, and nutrition services to low-income children (79). Specifically for child care centers, CACFP provides funds to for-profit centers with 25% or more low-income children and to public or private licensed nonprofit centers (80). Eligible child care centers receiving funds from CACFP must serve meals and snacks that meet the CACFP nutritional standards (80). While the CACFP nutritional guidelines do provide some standard for the food served to children in child care centers, these guidelines do not meet the nutrient standards recommended in the 2005 Dietary Guidelines for Americans (81). As a result, the meals and snacks offered in child care centers participating in the CACFP may not provide children with appropriate energy and proper nutrients for growth, health, and weight maintenance.

Only a small number of studies have examined the nutrients and foods children receive during their time at child care (83-87). Since the CACFP standards do not have energy and nutrient specifications, many studies rely on the recommended standards set by the American Dietetic Association (ADA) to determine the nutritional quality and quantity of foods served in child care settings. The ADA suggests that child care centers should provide one-half to two-thirds of the daily energy and nutrient requirements for children who attend centers at least eight hours per day (82). Additionally, the ADA recommends that the menus used and the foods served in child care centers should be consistent with the 2005 Dietary Guidelines (82). Oakley

et al (83) assessed the menus of licensed child care centers in Mississippi participating in the CACFP as well as the menus of non-participating centers. Findings revealed that the centers participating in the CACFP had menus with significantly lower amounts of energy, protein, and carbohydrates as well as other important vitamins and minerals such as vitamin A, vitamin B_6, vitamin E, and zinc compared to non-participating centers. Both centers participating in the CACFP and the non-participating centers had menus that exceeded the total fat recommendations for young children. In addition, many of the CACFP participating centers and the non-participating centers had menus that did not meet one-third of the nutrient requirements for energy, vitamin B_{12}, vitamin E, iron, calcium, and zinc (83). Therefore, several nutrients, essential for the growth and health of young children, may be lacking in the foods or combination of foods listed on the menus in child care centers.

Aside from assessing menus, observing children during mealtime may provide a more accurate estimate of children's dietary intake at child care centers. In 2008, Ball and colleagues (84) assessed whether the dietary intake of children in child care centers met one-half to two-thirds of the age-specific MyPyramid food group recommendations. The foods consumed were observed and recorded for 117 preschool-aged children in twenty North Carolina child care centers. Outcomes revealed that out of the five main MyPyramid food groups (grains, vegetables, fruits, milk, meat and beans) children met the one-half to two-third recommendation for milk only. However, 50% of the dietary intake of milk was whole milk, whereas only 11% of the milk was 1% or nonfat milk. Children only consumed 7% of the recommendations for dark green and orange vegetables, and whole grain consumption was less than 13% of the recommendations. Additionally, children consumed approximately 21% of the MyPyramid fruit recommendations. Researchers also observed that 75% of the meats consumed during meals

were high-fat or fried. Furthermore, 7% of children consumed sugar-sweetened beverages, 59% consumed a snack high in sugar, and 96% consumed condiments that were high in sugar and fat (84). These results suggest that the dietary intakes of children in child care centers may not meet the recommendations for whole grains, fruits, or vegetables and exceed the recommendations for fat and sugar intake (84).

Similarly, a previous study assessing children's food consumption in child care centers found inadequate intakes of grains, vegetables, and dairy in 3-year-old children while 4- and 5-year-old children only had adequate dairy intakes (85). Therefore, children attending the nine Texas child care centers that were examined did not meet two-thirds of the recommended intake for the majority of food groups (85). In general, the results of the studies assessing menus and dietary intake reveal that the meals and snacks prepared at child care centers may lack adequate amounts of nutrients for the proper growth and development of young children.

While much of the food consumed in child care centers may be prepared at the centers, meals and snacks may not always be provided by the centers. Rather, some children may consume meals and snacks that have been sent from home. A study by Bruening et al (86) compared the nutritional intakes of children consuming meals from a CACFP participating center to the dietary intakes of children who ate meals sent from home. Findings from this study showed that children who consumed meals prepared by the CACFP participating center had significantly higher intakes of milk, vegetables, and protein than children who ate meals sent from home. In addition, children consuming meals prepared at the center had increased intakes of calcium, vitamin A, and riboflavin, compared to children who brought meals from home (86). As previously discussed, it is possible for the meals and snacks in CACFP participating child

care centers to fulfill the CACFP nutritional guidelines without meeting the recommended energy and nutrient requirements of young children. However, as this study revealed, the positive impacts of the government-funded program on children attending CACFP participating child care centers should not be disregarded (86).

Sweitzer et al (87) further investigated the nutrients provided by the lunches children brought from home by assessing the nutrient quality of sack lunches based on the Dietary Reference Intakes (DRIs) and the CACFP standards. Due to the rising costs associated with foodservice facilities in child care centers as well as current changes in Texas state regulations regarding child care nutrition standards, approximately 46% of child care centers in two Texas counties have stopped providing meals (88). Instead, these centers require that all meals and snacks be sent from home (87). Thus, the nutritional content of children's sack lunches was examined in five Texas child care centers. After determining an average nutrient content of the sack lunches for three days, the content of the lunches was then compared to the DRIs and the CACFP standards. Outcomes showed that the nutrients in sack lunches fall short of the DRIs and the CACFP standards. More than half of the children's sack lunches provided less than one-third of the DRI for energy, vitamin A, carbohydrates, calcium, iron, and zinc. Additionally, the average sodium content of lunches sent from home exceeded the DRI for sodium. Furthermore, sack lunches did not meet the CACFP standards for servings of milk, fruit, and vegetables (87). Before beginning this study, Sweitzer et al conducted an informal telephone survey to determine if other states were also requiring all meals and snacks to be sent from home (87). Out of 135 centers from Georgia, Tennessee, California, and Pennsylvania, 42% did not provide food and thus required all meals to be sent from home. Further investigation is needed to gain a more accurate picture of this trend. Overall, these two studies by Bruening et al (86) and Sweitzer et al

(87) showed that foods consumed by children in child care centers can vary. Improvements in nutrient content may be needed in meals served in centers as well as those provided from home.

Child Care Provider Feeding Styles, Child Dietary Intake, and Food Acceptance

Similar to parental feeding, feeding styles used by child care providers can also be derived from Baumrind's general parenting styles: authoritarian, authoritative, and permissive (54). Research reveals that child care providers' feeding styles can have an impact on children's dietary consumption and acceptance of foods (38-39). In a study by Hughes et al (38) the feeding styles of fifty, randomly selected Head Start child care providers were evaluated and observed in relation to children's dietary intake. A checklist derived from the Caregiver Feeding Styles Questionnaire (3) was used during observation of mealtime to assess feeding styles of the child care providers. Feeding styles were categorized into authoritative, authoritarian, and permissive. Permissive styles were further separated into two groups: indulgent and uninvolved (38). Indulgent feeding was defined as giving or offering additional food, whereas uninvolved was ignoring or showing lack of interest. Trained nutritionists recorded and measured the food consumed by 549 children during mealtime. The results of this study revealed that child care providers' use of indulgent feeding styles were positively correlated with children's intake of specific food groups including: vegetables, dairy, the given entrée, and starch. Additionally, children's dairy consumption was related to authoritative feeding styles exerted by child care providers. Authoritative and authoritarian feeding styles were the most observed styles used in this Head Start sample. These findings support the influential power that child care providers' feeding styles have on the development of dietary intake and feeding behaviors in children (38).

Another study compared the actions of child care providers and evaluated their effects on preschool children's acceptance of new fruits and vegetables (39). Preschoolers and child care providers were randomly assigned to one out of five different teacher action groups. These groups consisted of exposure, modeling, presenting a reward, insisting the child try one bite, and giving a choice. Giving children a choice to try the new food most resembles the authoritative feeding style, whereas insisting and rewarding are related to the authoritarian feeding style. Outcomes reveal that actions representative of the authoritative (choice) and authoritarian (insisting and rewarding) feeding styles were more effective in preschoolers' acceptance of new foods than simple exposure to foods and modeling (39). Furthermore, giving children a choice rather than insisting resulted in more bites taken of the new food (39).

Altogether, the feeding styles used by child care providers have the potential to impact the dietary consumption and food acceptance of young children. However, it is important to consider both the benefits and disadvantages that feeding styles may have on the child's dietary intake. For example, the use of specific feeding styles may be able to increase the consumption of targeted foods such as fruits and vegetables, yet the overall impact on the child's energy consumption may be detrimental to the child's ability to self-regulate energy intake (38). Future research should examine the use of child care provider feeding styles and their long-term impact on children's consumption of specific foods as well as overall energy consumption.

Child Care Provider Dietary Modeling

Along with feeding styles, child care providers can potentially shape development of feeding behaviors and acceptance of new foods in children through dietary modeling. The American Dietetic Association recommends that child care providers play an integral role at

mealtime by sitting, eating, and engaging with the children (82). While there is evidence that supports the use of teacher and adult modeling as an effective way to increase children's food acceptance (40-41), other results are conflicting (39-40). One study in particular found dietary modeling to be both an influential and non-influential factor when determining child food acceptance (40). Effectiveness varied based on the actions, expressions, and statements the child care provider used during mealtime. When providers simply ate with the children, consumed the same foods, and made very limited comments regarding the foods, dietary modeling was shown to be ineffective in increasing the child's consumption of familiar and new foods. However, dietary modeling had a significant effect when the child care provider ate with the children, consumed the same foods, and also made enthusiastic statements about the foods before tasting them. For example, teachers would say, "These are delicious!" and then taste the food (40). These comments raised the children's awareness of the foods being consumed by the child care provider and also called attention to the actions of the provider. Furthermore, this study found that this sample of child care providers perceived dietary modeling as an important and valuable technique to increase children's food acceptance. This finding is consistent with outcomes of another study (42) in which the majority of child care providers believed that dietary modeling was an influential factor in shaping children's eating habits and acceptance of foods. In contrast, observations of the 113 child care providers revealed that 53% sat with the children during mealtime and consumed the same foods as the children. Providers who did not eat the same foods as the children frequently ate fast food, drank sodas, or did not eat (42). Additionally, several providers who ate the same foods as the children often drank sodas during the meal. Therefore, child care providers may agree with the impact of dietary modeling on children's eating habits, though they may not consistently practice recommended behaviors during

mealtime. Additional research is needed to determine the effectiveness of dietary modeling within the child care environment as well as the benefits associated with the child care provider's actions and comments during mealtime.

Meal Structure and Social Context within the Child Care Setting

Child care providers also have the opportunity to teach young children optimal dietary behaviors by following recommendations related to meal structure and establishing a positive social context during mealtime. Child care providers should be responsive to the hunger and satiety cues of children instead of trying to excessively regulate their intake of foods (82). Young children are believed to be able to innately control their energy intake (89), thus the implementation of family-style meal service is a recommended method that encourages the self-regulation of energy consumption in children (82). When children are served a family-style meal in the child care setting, all children eat the same foods and are given the ability to select and eat their own portions. A study by Sigman-Grant et al (43) found that children, two to five years of age, served themselves smaller portions of food than the amount they were given by the child care provider. Additionally, the children had less waste after self-serving the smaller food portion (43). Therefore, family-style meals rely more on the children's ability to self-regulate food intake and less on the child care provider's regulation of the children's food consumption.

Creating a positive social context during mealtime is also recommended for the development of appropriate feeding behaviors in children (82). Mealtime should be a time that children can relax and talk with one another, while child care providers converse with children about their foods and minimize any conflicts that may arise (82). Gable et al (44) found general mealtime conversation to be less than expected among children and child care providers in the

Head Start program. Additionally, teaching children about foods and nutrition was found to be infrequent (44). Mealtimes represent an important but possibly underutilized opportunity to discuss the foods being eaten and to teach about nutrition while creating a positive environment in which children can enjoy their food and socialize with others.

Child Care Provider Nutrition Knowledge, Beliefs, and Training

For child care providers to be able to adequately teach children about nutrition, they must be knowledgeable of the basic nutrition standards for preschoolers. Evidence shows that there is a need for child care providers to be more informed about nutrients in foods and general dietary recommendations for children (42, 91). A study assessing nutrition knowledge, attitudes, and behaviors of child care providers in twenty-four centers across Illinois (42) found positive correlations between behavior and both nutrition knowledge and perceptions regarding child feeding. These outcomes suggest that child care providers with greater nutrition knowledge and healthy perceptions regarding the roles of both the child and the provider in the mealtime setting may result in more desirable behaviors displayed during mealtime (42). Therefore, these results suggest that child care providers benefit from knowledge of current dietary recommendations as well as the basic nutrition standards and principles for young children.

Given that the type and depth of nutrition training can vary greatly among child care providers (38), training and educational materials may be helpful so that the provider can more effectively teach children about nutrition and the benefits of good health. Dunn et al (91) designed a nutrition and physical activity curriculum entitled, *Color Me Healthy*, trained child

care providers on the curriculum, and assessed its impact on child knowledge of healthy behaviors within the child care setting. Findings revealed that 93% of child care providers felt that using the curriculum increased the children's knowledge about nutrition in regards to healthy eating (91). Additionally, 92.3% of child care providers reported that the curriculum gave them a better understanding of the importance of educating children about basic nutrition principles (91). The outcomes of this study suggest that training child care providers on a specific nutrition and physical activity curriculum is an effective way not only to educate providers but also to teach preschool-aged children the benefits of healthy eating and exercise.

In addition, the About Feeding Children Study (43) reported that among 11,661 licensed child care centers in California, Idaho, Colorado, and Nevada, training on child feeding was not required. However, 43% of child care providers reported attending training on child feeding taught by center directors (43). These additional training sessions are important opportunities in which registered dietitians could get involved by either teaching or designing a training module to be taught by the director. Nutrition professionals could further educate child care providers about appropriate feeding behaviors, development of the mealtime environment, the significance of the child's ability to self-regulate energy intake, and basic nutrition principles. Overall, the development of educational materials and training programs for child care providers may be a valuable way to establish appropriate eating and physical activity behaviors during the early years of life.

Early Childhood Education Students as Future Child Care Providers

Various studies have investigated the impact that child care providers have on children's eating patterns and behaviors. Those that have been discussed found that child care providers have the potential to influence preschoolers' eating patterns through feeding styles (38-39), dietary modeling (40-41), and family-style meal service (43). In addition, evidence suggests that eating patterns established in the earlier years of life are likely to continue into later stages (50, 53). Therefore, the child care environment is a vital setting for the investigation of possible modifiable risk factors contributing to childhood obesity and overall health. Previous limited research has mainly focused on child care providers and their influence on children's eating behaviors. However, little research has been conducted among Early Childhood Education students, the future leaders in early childhood education including out of home care for children ages two through six. Because the educational requirements vary greatly for this field of practice, those with a bachelor's degree are qualified to attain administrative positions and to develop policy related to early childhood education (46). Given that many of these students may eventually become influential leaders in child care and early education, it is of great value for these students to have knowledge of the importance of nutrition and child feeding within the child care setting. However, course curriculum requirements differ among Early Childhood Education programs from separate institutions of higher learning (92-93). Some programs include a nutrition course as a requirement (93), whereas others do not (92). Thus, it is important to consider the students' completion of a nutrition course to determine whether collegiate training has any impact on knowledge and attitudes regarding child feeding. Additionally, practicum training also plays a vital role in career preparation for Early Childhood Education students (94). The early childhood practicum provides students with the opportunity to learn in

interactive environments and to apply their classroom knowledge (94). Therefore, it is also important to consider students' completion of an early childhood practicum to determine its role in contributing to students' nutrition knowledge and child feeding practices. Since greater knowledge of nutrition and optimal child feeding practices may result in more optimal feeding practices during mealtime (42), it is important to assess the nutrition knowledge and child feeding practices of early childhood educators. Subsequently, this information may lead to more directed development and effective implementation of nutrition training curricula specific to child care providers, thus nurturing a positive environment for the development of appropriate child eating patterns and behaviors.

Research Questions

With this goal in mind, the specific aims of this proposed study are to:

1. Describe the nutrition knowledge and child care feeding practices among students enrolled in Early Childhood Education programs.

2. Determine the extent to which there is a relationship between nutrition knowledge and child care feeding practices.

3. Determine the extent to which there is a relationship between nutrition knowledge and child care feeding practices with completion of a college-level nutrition course.

4. Determine the extent to which there is a relationship between nutrition knowledge and child care feeding practices with completion of a practicum in Early Childhood Education.

References

1. Centers for Disease Control and Prevention. *Obesity: Halting the Epidemic by Making Health Easier*. Available at: http://www.cdc.gov/nccdphp/publications/AAG/pdf/obesity.pdf. Accessed: October 20, 2009.

2. Freedman DS, Mei Z, Srinivasan SR, Berenson GS, Dietz WH. Cardiovascular risk factors and excess adiposity among overweight children and adolescents: the Bogalusa Heart Study. *J Pediatr*. 2007;150:12–17.

3. Hoerr SL, Hughes SO, Fisher JO, Nicklas TA, Liu Y, Shewchuk RM. Associations among parental feeding styles and children's food intake in families with limited incomes. *Int J Behav Nutr Phys Act.* 2009;6:55.

4. Hughes SO, Power TG, Fisher JO, Mueller S, Nicklas TA. Revisiting a neglected construct: parenting styles in a child-feeding context. *Appetite.* 2005;44:83-92.

5. Zeinstra GG, Koelen MA, Kok FJ, Van der Laan N, Graaf CD. Parental child-feeding strategies in relation to Dutch children's fruit and vegetable intake. *Public Health Nutr.* 2009;22:1-10.

6. Hubbs-Tait L, Kennedy TS, Page M, Topham GL, Harrist AW. Parental feeding practices predict authoritative, authoritarian, and permissive parenting styles. *J Am Diet Assoc.* 2008;108:1154-1161.

7. Patrick H, Nicklas TA, Hughes SO, Morales M. The benefits of authoritative feeding style: caregiver feeding styles and children's food consumption patterns. *Appetite.* 2005;44:243-249.

8. Hughes SO, Shewchuk RM, Baskin ML, Nicklas TA, Qu H. Indulgent feeding style and children's weight status in preschool. *J Dev Behav Pediatr*. 2008;29:403-410.

9. Moens E, Braet C, Soetens B. Observation of family functioning at mealtime: A comparison between families of children with and without overweight. *J Pediatr Psych.* 2007;32:52-63.

10. Wardle J, Sanderson S, Guthrie CA, Rapoport L, Plomin R. Parental feeding style and the inter-generational transmission of obesity risk. *Obesity Research.* 2002;10:453-462.

11. Blissett J, Haycraft E. Are parenting style and controlling feeding practices related? *Appetite.* 2008;50:477-485.

12. Brann LS, Skinner JD. More controlling child-feeding practices are found among parents of boys with an average body mass index compared with parents of boys with a high body mass index. *J Am Diet Assoc.* 2005;105:1411-1416.

13. Hupkens CLH, Knibbe RA, Van Otterloo AH, Drop MJ. Class differences in the food rules mothers impose on their children: A cross-national study. *Soc Sci Med*. 1998;47:1331-1339.

14. Gubbels JS, Kremers S, Stafleu A, Dagnelie P, Goldbohm RA, De Vries NK, Thijs C. Diet-related restrictive parenting practices. Impact on dietary intake of 2-year-old children and interactions with child characteristics. *Appetite*. 2009;52:423-429.

15. Fisher JO, Birch LL. Parents' restrictive feeding practices are associated with young girls' negative self-evaluation of eating. *J Am Diet Assoc*. 2000;100:1341-1346.

16. Fisher JO, Birch LL. Restricting access to palatable foods affects children's behavioral response, food selection, and intake. *Am J Clin Nutr*. 1999;69:1264-1272.

17. Birch LL, Fisher JO, Davison K. Learning to overeat: maternal use of restrictive feeding practices promotes girls' eating in the absence of hunger. *Am J Clin Nutr*. 2003;78:215-220.

18. Galloway AT, Fiorito LM, Francis LA, Birch LL. 'Finish your soup': Counterproductive effects of pressuring children to eat on intake and affect. *Appetite*. 2006;46:318-323.

19. Powers SW, Chamberlin LA, Van Schaick KB, Sherman SN, Whitaker RC. Maternal feeding strategies, child eating behaviors, and child BMI in low-income African-American preschoolers. *Obesity*. 2006;14:2026-2033.

20. Matheson DM, Robinson TN, Varady A, Killen JD. Do Mexican-American mothers' food-related parenting practices influence their children's weight and dietary intake? *J Am Diet Assoc*. 2006;106:1861-1865.

21. Carnell S, Wardle J. Associations between multiple measures of parental feeding and children's adiposity in United Kingdom preschoolers. *Obesity*. 2007;15:137-144.

22. Skinner JD, Carruth BR, Bounds W, Ziegler PJ. Children's food preferences: A longitudinal analysis. *J Am Diet Assoc*. 2002;102:1638-1647.

23. Skinner JD, Carruth BR, Moran J III, Houck K, Schmidhammer J, Read A, Coletta F, Cotter R, Ott D. Toddlers' food preferences: concordance with family members' preferences. *J Nutr Educ*. 1998;30:17-22.

24. Birch LL, Fisher JO. Development of eating behaviors among children and adolescents. *Pediatrics*. 1998;101:539-549.

25. Fisher JO, Mitchell DC, Smicklas-Wright H, Birch LL. Parental influences on young girls' fruit and vegetable, micronutrient, and fat intakes. *J Am Diet Assoc*. 2002;102:58-64.

26. Munsch S, Hasenboehler K, Michael T, Meyer AH, Roth B, Biedert E, Margraf J. Restrained eating in overweight children: Does eating style run in families? *Int J Pediatr Obes.* 2007;2:97-103.

27. Tibbs T, Haire-Joshu D, Schechtman KB, Brownson RC, Nanney MS, Houston C, Auslander W. The relationship between parental modeling, eating patterns, and dietary intake among African-American parents. *J Am Diet Assoc.* 2001;101:535-541.

28. Borah-Giddens J, Falciglia GA. A meta-analysis of the relationship in food preferences between parents and children. *J Nutr Educ.* 1993;25:102-107.

29. Wardle J, Cooke LJ, Gibson EL, Sapochnik M, Sheiham A, Lawson M. Increasing children's acceptance of vegetables; a randomized trial of parent-led exposure. *Appetite*. 2003;40:155-162.

30. Birch LL, McPhee L, Shoba BC, Pirok E, Steinberg L. What kind of exposure reduces children's food neophoba? Looking vs tasting. *Appetite.* 1987;9:171-178.

31. Liem DG, Graaf C. Sweet and sour preferences in young children and adults: role of repeated exposure. *Physiol Behav.* 2004;83:421-429.

32. Nicklas TA, O'Neil CE, Berenson GS. Nutrient contribution of breakfast, secular trends, and the role of ready-to-eat cereals: a review of data from the Bogalusa Heart Study. *Am J Clin Nutr*. 1998;67:757S-763S.

33. Dubois L, Girard M, Potvin KM. Breakfast eating and overweight in a pre-school population: is there a link? *Public Health Nutr*. 2006;9:436-442.

34. Stanek K, Abbott D, Cramer S. Diet quality and the eating environment of preschool children. *J Am Diet Assoc*. 1990;90:1582-1584.

35. Burgess-Champoux TL, Larson N, Neumark-Sztainer D, Hannan PJ, Story M. Are family meal patterns associated with overall diet quality during the transition from early to middle adolescence? *J Nutr Educ Behav*. 2009;41:79-86.

36. Bourcier E, Bowen DJ, Hendrika M, Moinpour C. Evaluation of strategies used by family food preparers to influence healthy eating. *Appetite*. 2003;41:265-272.

37. Gibson EL, Wardle J, Watts CJ. Fruit and vegetable consumption, nutrition knowledge and beliefs in mothers and children. *Appetite*. 1998;31:205-228.

38. Hughes SO, Patrick H, Power T, Fisher JO, Anderson CB, Nicklas TA. The impact of child care providers' feeding on children's food consumption. *J Dev Behav Pediatr.* 2007;28:100-107.

39. Hendy HM. Comparison of five teacher actions to encourage children's new food acceptance. *Ann Behav Med.* 1999;21(1):20-26.

40. Hendy HM, Raudenbush B. Effectiveness of teacher modeling to encourage food acceptance in preschool children. *Appetite*. 2000;34:61-76.

41. Addessi E, Galloway AT, Visalberghi E, Birch LL. Specific social influences on the acceptance of novel foods in 2-5-year-old children. *Appetite*. 2005;45:264-271.

42. Nahikian-Nelms M. Influential factors of caregiver behavior at mealtime: a study of 24 child-care programs. *J Am Diet Assoc*. 1997;97:505-509.

43. Sigman-Grant M, Christiansen E, Branen L, Fletcher J, Johnson SL. About Feeding Children: Mealtimes in child-care centers in four western states. *J Am Diet Assoc.* 2008;108:340-346.

44. Gable S, Lutz S. Nutrition socialization experiences of children in the Head Start Program. *J Am Diet Assoc*. 2002;101:572-577.

45. Federal Interagency Forum on Child and Family Statistics. America's Children National Indicators of Well-being 2002. Available at: http://www.childstats.gov/americaschildren/tables/fam3b.asp. Accessed: November 8, 2009.

46. United States Department of Labor. Bureau of Labor and Statistics: Child Care Workers. 2009. Available at: http://www.bls.gov/oco/ocos170.htm. Accessed: December 4, 2009.

47. Ogden CL, Carroll MD, Curtin LR, Lamb MM, Flegal KM. Prevalence of high body mass index in US children and adolescents, 2007-2008. *JAMA.* 2010;303(3):242-249.

48. Centers for Disease Control and Prevention. *About BMI for Children and Teens.* Available at: http://www.cdc.gov/healthyweight/assessing/bmi/childrens_BMI/about_childrens_BMI.html#What is BMI percentile. Accessed: November 2, 2009.

49. Himes JH, Dietz WH. Guidelines for overweight in adolescent preventive services: recommendations from an expert committee. The expert committee on clinical guidelines for overweight in adolescent preventive services. *Am J Clin Nutr*. 1994;59:307-316.

50. Branen L, Fletcher J. Comparison of college students' current eating habits and recollections of their childhood food practices. *J Nutr Educ.* 1999;31:304-310.

51. Wardle J. Parental influences on children's diets. *Proc Nutr Soc.* 1995; 54:747-758.

52. Greenough WT, Black JE, & Wallace CS. Experience and brain development. *Child Dev.* 1987; 58:539-559.

53. Birch LL, Davidson KK. Family environmental factors influencing the developing behavioral controls of food intake and childhood overweight. *Pediatr Clin North Am*. 2001;48:87-104.

54. Baumrind D. Current patterns of parental authority. *Developmental Psychology Monograph, Part 2.* 1971;4:1-103.

55. Fox MK, Devaney B, Reidy K, Razafindrakoto C, Ziegler P. Relationship between portion size and energy intake among infants and toddlers: evidence of self-regulation. *J Am Diet Assoc.* 2006;106:S77-S83.

56. Rolls BJ, Engell D, Birch LL. Serving portion size influences 5-year-old but not 3-year-old children's food intakes. *J Am Diet Assoc*. 2000;100:232-234.

57. Birch LL, Fisher JO, Grimm-Thomas K, Markey CN, Sawyer R, Johnson SL. Confirmatory factor analysis of the Child Feeding Questionnaire: a measure of parental attitudes, beliefs, and practices about child feeding and obesity proneness. *Appetite.* 2001;36:201-210.

58. U.S. Department of Labor, Bureau of Labor Statistics. Mothers in the Labor Force, by Age of Child: 1975-2006. Available at: http://mchb.hrsa.gov/chusa07/popchar/pages/106wmcc.html. Accessed: November 9, 2009.

59. National Center for Education Statistics. Child care arrangements of 3- to 5-year old children who are not yet in kindergarten, by age and race/ethnicity: 2005. Available at: http://nces.ed.gov/fastfacts/display.asp?id=4. Accessed: November 8, 2009.

60. U.S. Census Bureau. Who's Minding the Kids? Child Care Arrangements: Winter 2002. Available at: http://www.census.gov/prod/2005pubs/p70-101.pdf. Accessed: November 8, 2009.

61. Peisner-Feinberg ES. Child care and its impact on young children's development. Encyclopedia on Early Childhood Development. 2004. Available at: http://www.enfant-encyclopedie.com/Pages/PDF/Peisner-FeinbergANGxp.pdf. Accessed: July 2, 2010.

62. National Institute of Child Health and Human Development Early Child Care Research Network. Early child care and children's development prior to school entry: Results from the NICHD Study of Early Child Care. *Am Ed Res J.* 2002;39(1):133-164.

63. Howes C. The impact of child care on young children (0-2). Encyclopedia on Early Childhood Development. 2003. Available at: http://www.enfant-encyclopedie.com/Pages/PDF/HowesANGxp.pdf. Accessed: July 2, 2010.

64. Whitebook M, Howes C, Phillips D. Who cares? Child care teachers and the quality of care in America. Final report of the National Child Care Staffing Study. 1989. Available at: http://www.eric.ed.gov/PDFS/ED323031.pdf. Accessed: July 2, 2010.

65. Dunn L. Proximal and distal features of day care quality and children's development. *Early Child Res Q.* 1993;8(2):167-192.

66. Bryant DM, Burchinal M, Lau LB, Sparling JJ. Family and classroom correlates of Head Start children's developmental outcomes. *Early Child Res Q.* 1994;9(3-4):289-304.

67. Burchinal MR, Roberts JE, Riggins R, Zeisel SA, Neebe E, Bryant D. Relating quality of center-based child care to early cognitive and language development longitudinally. *Child Dev.* 2000;71(2):338-257.

68. Clarke-Stewart KA, Lowe-Vandell D, Burhcinal M, O'Brien M, McCartney K. Do regulable features of child-care homes affect children's development? *Early Child Res Q.* 2002;17(1):52-86

69. National Institute of Child Health and Human Development Early Child Care Research Network. Does quality of child care affect child outcomes at age 4½? *Dev Psychol.* 2003;29(3):451-469.

70. Peisner-Feinberg ES, Burchinal MR, Clifford RM, Culkin ML, Howes C, Kagan SL, Yazeijian N. The relation of preschool child-care quality to children's cognitive and social developmental trajectories through second grade. *Child Dev.* 2001;72(5):1534-1553.

71. Broberg AG, Wessels H, Lamb ME, Hwang CP. Effects of day care on the development of cognitive abilities in 8-year-olds: A longitudinal study. *Dev Psychol.* 1997;33(1):62-69.

72. Assel MA, Landry SH, Swank PR, Gunnewig S. An evaluation of curriculum, setting, and mentoring on the performance of children enrolled in pre-kindergarten. *Read Writ.* 2007;20:463-494.

73. Early DM, Bryant DM, Pianta RC, Clifford RM, Burchinal MR, Ritchie S, Howes C, Barbarin O. Are teachers' education, major, and credentials related to classroom quality and children's academic gains in pre-kindergarten? *Early Child Res Q.* 2006;21:174-195.

74. LoCasale-Crouch J, Konold T, Pianta R, Howes C, Burchinal M, Bryant D, Clifford R, Early D, Barbarin O. Observed classroom quality profiles in state-funded pre-

kindergarten programs and associations with teacher, program, and classroom characteristics. *Early Child Res Q.* 2007;22, 3-17.

75. Howes C, Hamilton CE. Children's relationships with caregivers: mothers and child care teachers. *Child Dev*. 1992;63:859-866.

76. Story M, Kaphingst KM, French S. The role of child care settings in obesity prevention. *Future Child.* 2006;16:143-168.

77. U.S. General Accounting Office. Child Care: State Efforts to Enforce Safety and Health Requirements. Available at: http://www.gao.gov/new.items/he00028.pdf. Accessed: April 13, 2010.

78. Kaphingst KM, Story M. Child care as an untapped setting for obesity prevention: state child care licensing regulations related to nutrition, physical activity, and media use for preschool-aged children in the United States. *Prev Chronic Dis.* 2009;6:1-13.

79. National Head Start Association. About NHSA. Available at: http://www.nhsa.org/. Accessed April 9, 2010.

80. U.S. Department of Agriculture, Food and Nutrition Service. Child and Adult Care Food Program. Available at: http://www.fns.usda.gov/cnd/care/CACFP/aboutcacfp.htm. Accessed: April 9, 2010.

81. U.S. Department of Agriculture, Food and Nutrition Service. Dietary Guidelines for Americans 2005. Available at: http://www.health.gov/dietaryguidelines/dga2005/document/pdf/DGA2005.pdf. Accessed: April 9, 2010.

82. Position of the American Dietetic Association. Benchmarks for nutrition programs in child care settings. *J Am Diet Assoc.* 2005;105(6);979-986.

83. Oakley, C.B., Bomba, A.K., Knight, K.B., & Byrd, S.H. Evaluation of menus planned in Mississippi child-care centers participating in the Child and Adult Care Food Program. *J Am Diet Assoc*, 1995;95:765-768.

84. Ball SC, Benjamin SE, Ward DS. Dietary intakes in North Caroline child-care centers: are children meeting current recommendations? *J Am Diet Assoc*. 2008;108:718-721.

85. Padget A, Briley ME. Dietary intakes at child-care centers in central Texas fail to meet Food Guide Pyramid recommendations. *J Am Diet Assoc*. 2005;105:790-793.

86. Bruening KS, Gilbride JA, Passannante MR, McClowry S. Dietary intake and health outcomes among young children attending 2 urban day-care centers. *J Am Diet Assoc*. 1999;99:1529-1535.

87. Sweitzer SJ, Briley ME, Robert-Gray C. Do sack lunches provided by parents meet the nutritional needs of young children who attend child care? *J Am Diet Assoc*. 2009;109:141-144.

88. Enke A, Briley M, Curtis S, Staskel D. Quality management procedures influence the food safety practices in childcare centers. *Early Childhood Ed J*. 2007;35:75-81.

89. Drake M. Menu evaluation, nutrient intake of young children, and nutrition knowledge of menu planners in childcare centers in Missouri. *J Nutr Educ*. 1992;24:145-148.

90. US Department of Agriculture. Early Childhood and Child Care Study: Summary of Findings. Available at: http://www.fns.usda.gov/ora/MENU/published/CNP/FILES/CHLDCARE.PDF. Accessed: November 19, 2009.

91. Dunn C, Thomas C, Ward D, Pegram L, Webber K, Cullitan C. Design and implementation of a nutrition and physical activity curriculum for child care settings. *Prev Chronic Dis*. 2006;3(2):1-8.

92. The University of Tennessee, Knoxville. Child and Family Studies Major Guide for 2008-2009. Available at: http://www.utk.edu/academics/programs/08/ChldFamStud08.html. Accessed: January 6, 2010.

93. South Dakota State University. Requirements for Early Childhood Education Major. Available at: http://catalog.sdstate.edu/preview_program.php?catoid=12&poid=1972&returnto=search. Accessed: January 6, 2010.

94. Jacobs GM. Providing the scaffold: a model for early childhood/primary teacher preparation. *Early Child Educ J* 2001;2:125-130.

Part II

Nutrition Knowledge and Child Care Feeding Practices of Early Childhood Education Students

Disclosure

This article will be submitted to the Journal of the American Dietetic Association and the Journal of Nutrition Education and Behavior for review.

Author's contributions: Sarah White conducted the research and co-wrote the manuscript, and Melissa Hansen-Petrik formatted and designed the research, co-wrote the manuscript and had final responsibilities for all parts of the manuscript.

Abstract

The current study described the nutrition knowledge and child feeding practices of 33 Early Childhood Education students from seven universities across the United States. A web-based nutrition knowledge instrument was developed and validated to measure areas of nutrition knowledge for preschool-aged children that were pertinent to the early childhood student population. Child feeding practices were assessed using the Comprehensive Feeding Practices Questionnaire (CFPQ). Given that the CFPQ has been previously validated in parents, the CFPQ was slightly modified for use in the current study to pertain to the early childhood education student population. Mean scores for the nutrition knowledge and child feeding practices were determined. Multivariate analyses were used to determine differences in mean nutrition knowledge and feeding practices scores across sample characteristics. Early Childhood Education students were found to have more knowledge of MyPyramid food groups and dietary sources of nutrients than dietary intake recommendations for preschoolers. Students who had completed a college-level nutrition course scored higher on MyPyramid food groups and food sources of nutrients than those who had not, although these differences were not statistically significant. A nonsignificant trend was found in knowledge of dietary recommendations according to practicum status. In addition, students who had not started a practicum agreed with using food as a reward significantly more than students who had completed a practicum. Results from the present study suggest roles for both nutrition coursework and practicum training in optimizing nutrition knowledge and child feeding practices among future leaders in early childhood education.

Introduction

Eating patterns and behaviors established during the early years of life have been found to persist into adolescence and adulthood (1). Therefore, the preschool years are a critical period for the development of healthful lifelong dietary habits. Dietary behaviors established during these early years, may contribute to overweight and obesity in later childhood and into adulthood. Thus, the feeding environment of young children, if suboptimal, may be a risk factor contributing to childhood overweight and obesity.

Parental feeding styles have been shown to positively or negatively impact children's consumption of healthful foods (2-4). Feeding styles can be defined by the amount of parental control versus the amount of child control within the parent-child relationship: authoritarian feeding style is characterized by high demandingness and control and low responsiveness; authoritative feeding style is referred to as high demandingness and responsiveness; permissive style is distinguished by low demandingness and responsiveness (5). Specifically, the use of permissive feeding styles has been shown to be negatively associated with child fruit, vegetable, and dairy intake (3), whereas other studies have found authoritative feeding styles to be positively associated with dietary intake and encouraging healthy eating (6-7). In addition to feeding styles, parents may also influence their children's eating behavior and dietary intake through their preparation of foods, structuring meals, modeling dietary behaviors, making food available and accessible, and directing the social context of meals (8-12). While parents play an important role in shaping the eating habits of children, many young children may be exposed to non-parental caregivers who have the potential to influence and shape dietary behaviors as well.

In the United States, the number of children, ages 2-6, participating in child care has substantially increased within the past three decades (13). Approximately 12 million U.S.

children under the age of six regularly participate in non-parental child care and spend approximately 36 hours per week apart from their parents (14-15). Due to the substantial number of children that regularly attend and spend a large amount of time in non-parental care, the responsibility for promoting healthful eating patterns, behaviors, and dietary intakes in children is shifting to a shared responsibility of the parent and child care provider.

Previous research has found that child care providers, like parents, have the potential to influence children's eating behaviors through certain feeding styles during mealtime (16-17), modeling feeding behaviors and dietary intake (18-19), establishing the social context of meals (20), and through their own nutrition knowledge and beliefs (21-22). While some research has been conducted on the roles of child care providers, there has been little research on Early Childhood Education students, who are positioned to attain administrative positions and make policy related to child care. Adequate nutrition knowledge and optimal child feeding practices are imperative for developing policies and feeding environments that promote positive eating habits and behaviors in children. Both nutrition coursework and practicum training may play roles in optimizing nutrition knowledge and child feeding practices in Early Childhood Education students. The purpose of this study was to describe the nutrition knowledge and reported child care feeding practices of Early Childhood Education students from geographically diverse university settings and to determine the extent to which nutrition knowledge and child feeding practices are related to completion of a college-level nutrition course and a practicum in early childhood education.

Methods

Subjects

Individuals recruited to participate in this study consisted of students majoring in Early Childhood Education programs at institutions of higher learning throughout the United States. Select Early Childhood Education program faculty at institutions that offer a baccalaureate in Early Childhood Education were contacted and informed about the study through a faculty member in Child and Family Studies and through other professional contacts. Faculty members who agreed to participate were asked to forward a web-based survey link to all graduating seniors majoring in Early Childhood Education at their respective institutions. Altogether, eleven Early Childhood Education programs were contacted, and seven out of eleven programs agreed to participate. Each U.S. region (northeast, south, midwest, and west) was represented by at least one of the seven participating programs. Approval for this study was obtained from the University of Tennessee Institutional Review Board prior to initiation of study protocols.

Data Collection Methods

Web-based surveys were designed specifically for this study to acquire information regarding the particular research aims. Electronic surveys were deemed the most effective method to obtain a large amount of information with a minimal expense of time and cost for survey distribution. Reduced time spent entering data and averted potential for introducing error during the data entry process also contributed to the efficiency of this method. In addition, the population surveyed in this research study was believed to have computer access through their

respective institutions as well as the skills necessary to complete a web-based survey. Furthermore, students were given a college or university email address upon enrollment in school, thus providing a means of communication and availability.

Survey Instrument

A survey instrument was developed to obtain the pertinent information needed to achieve the specific aims of this study (Appendix). The survey was designed and administered through SPSS mrInterview™ (23). This electronic survey software allowed for access to the survey by participants via the World Wide Web. Additionally, data obtained from the electronic surveys were downloaded directly into the SPSS statistical analysis software (24), thus eliminating manual data entry. SPSS mrInterview™ software was available through the University of Tennessee, Knoxville.

Measures

The survey consisted of three sections: (a) nutrition knowledge, (b) child care feeding practices, and (c) demographic and sample characteristics.

Nutrition knowledge. This component of the survey contained questions designed to assess the students' knowledge about nutrition in young children. Twenty-two questions specific to preschool-aged children were developed based on the 2005 Dietary Guidelines (25), the Dietary Reference Intakes (26), the USDA MyPyramid (27), and the Healthy People 2010

Objectives (28). These dietary standards were used since they are considered the optimal recommendations for the health and development of young children. Three nutrition knowledge topic areas were identified as critical to assessment of nutrition knowledge in the target population. These include knowledge of dietary recommendations for preschool children, food placement in MyPyramid food groups, and nutrient and food source identification. These topic areas and the questions were consistent with those developed for prior nutrition knowledge assessment instruments (29-31).

Child care feeding practices. This section of the survey contained questions designed to assess child care feeding practices using select subscales from the Comprehensive Feeding Practices Questionnaire (CFPQ) (27). The CFPQ is a validated 49-item scale that measures parental feeding practices. For this study, seven of the twelve subscales were excluded because they pertained solely to parents and could not be extrapolated to child care providers. The five subscales that remained were: encourage balance and variety, food as reward, modeling, pressure, and teaching about nutrition. Every question from each of these five subscales was included in the survey. Responses were formatted on a five-point response scale from 1 (disagree) to 5 (agree). The wording of items in these five subscales was slightly modified to pertain to future child care providers rather than to parents. For example, "I show my child how much I enjoy eating healthy foods" was modified to "I show children how much I enjoy eating healthy foods."

Demographic and sample characteristics. This section of the survey contained questions designed to determine prior nutrition training and child feeding responsibilities of the Early Childhood Education students. This section also collected information about participant

characteristics including dietary habits and behaviors, collegiate education, career goals, age, gender, ethnicity, height, weight, current number of children, and geographic region of the United States. Reported dietary behaviors were measured using high loading items from the restrained eating subscale from the Dutch Eating Behavior Questionnaire (28) and from questions pertaining to the frequency of intake of specific indicator foods. Collecting information on the training, experience, and demographics of the students allowed the researchers to determine relationships between participant characteristics and both nutrition knowledge and child feeding practices.

Survey Instrument Review and Validation

Content validity of the survey instrument was established via review by an expert panel consisting of four registered dietitians with master's or doctoral degrees and expertise in early childhood nutrition as well as one professor in early childhood education. The survey was sent via an email attachment directly to these experts and feedback was collected (Appendix). Revisions and modifications to the survey content and design were made after completion of the panel review to assure that the survey would efficiently collect the information and data most pertinent to the study aims.

Pilot Testing

Following expert panel review, the survey was pilot tested in a small sample of similar participants at the University of Tennessee, Knoxville. The survey was emailed to the Early

Childhood Education Internship Coordinators, who then forwarded the survey to all graduating seniors in the program. The director of the Didactic Program in Dietetics at the University of Tennessee likewise distributed the survey to senior nutrition majors in order to establish construct validity. The survey email contained directions for completing the survey and the survey web address. Internship coordinators were asked to forward a follow-up email reminder five calendar days after sending the initial survey email. This test yielded 10 out of 28 responses from students majoring in Early Childhood Education. Twenty out of 40 nutrition majors responded. Respondents reported no problems with accessing or completing the survey. As an incentive to participate, educational sessions based on survey content and refreshments were provided if a benchmark of 50% of students from each respective program completed the survey.

After the pilot survey was completed, nutrition knowledge questions that were answered correctly by less than 20% and more than 80% of early childhood education majors were considered for removal (Appendix). The score of each nutrition knowledge item was also correlated with the overall nutrition knowledge test score. If the correlation was <0.2, the item was considered for removal. Two of the nutrition knowledge questions were removed and the content of some questions were modified. Additionally, internal consistency reliability for each subsection of the nutrition knowledge survey was determined by establishing Cronbach's alpha.

Survey Administration

A geographically-diverse sample of Early Childhood Education program faculty across the United States was contacted via a Child and Family Studies faculty member at the University

of Tennessee and through other professional contacts. Contacted faculty were informed of the purpose of the study and asked if they were willing to forward the study invitation and survey link to graduating seniors majoring in early childhood education. Faculty who agreed to forward survey information to students were contacted via a follow up email including: information for students on survey purpose, a link to the survey, contact information for the researchers at the University of Tennessee, and directions on sending the exact email on to graduating seniors enrolled in their respective institutions.

After the survey was initially sent to the students, they were given fourteen calendar days to complete the survey. As an incentive to participate, students had the option of providing an email address to participate in a drawing for store gift cards. Two follow-up email reminders were sent on day five and day ten during the two weeks encouraging students to complete the survey. At the end of the two week period, the survey responses were downloaded from the SPSS mrInterview™ software into the SPSS statistical analysis software to proceed with data analysis.

Data Analysis

All statistical analyses were performed using SPSS version 17.0 for windows statistical software (19). Basic descriptive statistics were performed on all sociodemographic variables to establish characteristics of this sample of graduating seniors in Early Childhood Education programs throughout the United States.

Mean scores on the nutrition knowledge and the child care feeding practices portions of the survey were determined. A correlation analysis was performed on the mean nutrition knowledge scores and the mean feeding practices scores to determine the extent to which there was a relationship between the variables. Analyses of variance, multivariate analyses, and t-tests were used to assess the differences in mean nutrition knowledge and child feeding practices scores across the determinant characteristics. Therefore, in these analyses the Early Childhood Education students' characteristic variables were measured against: nutrition knowledge scores and mean child feeding practices scores.

Results

Sample Description

Table 1 presents the demographic characteristics of the study sample. The majority of the sample was female (97%), non-Hispanic white (75.8%), and between 20-24 years of age (90.8%). There were more students who were seniors (n=15) compared to juniors (n=9), sophomores (n=4), and graduate students (n=4). About one-half of the sample had completed an early childhood practicum (n=15), whereas other students were currently enrolled (n=9) or had not started a practicum (n=9). Career goals varied. However, most of the respondents desired to become early childhood or elementary school teachers (78.8%). Fourteen students had completed a college-level nutrition course and 19 had not completed a course in nutrition. Further, there were more healthy weight participants (n=23) than overweight and obese participants (n=6) for an overall 18.2% prevalence of overweight and obesity in the sample.

Table 1.
Description of Study Sample (n=33)

	N	Percentage
Gender		
Male	1	3
Female	32	97
Ethnic Origin		
White, non-Hispanic	25	75.8
Hispanic	3	9.1
Asian or Pacific Islander	2	6.1
Other	3	9.1
Age		
<20	1	3
20-24	30	90.8
>24	2	6.1
Major		
Early Childhood Education	29	87.9
Elementary Education	4	12.1
Geographic Residence		
Arizona	7	21.2
Illinois	5	15.2
Iowa	7	21.2
Louisiana	9	27.3
New York	2	6.1
South Carolina	2	6.1
South Dakota	1	3
Academic Year		
Sophomore	4	12.1
Junior	9	27.3
Senior	15	45.5
Graduate	4	12.1
No Answer	1	3
Career Goals		
Develop Child Care Policy	1	3
Early Childhood Teacher	13	39.4
Elementary School Teacher	13	39.4
Other:		
Early Childhood and/or Elementary Teacher	2	6.1
Early Intervention	1	3
Earn a Master's Degree	3	9.1
Practicum Status		
Completed Practicum	15	45.5
Practicum in Progress	9	27.3
Practicum Not Started	9	27.3
Completion of Nutrition Course		
Completed Course	14	42.2
Not Completed Course	19	57.6
Body Mass Index (kg/m^2)		
<18.5	2	6.1
18.5-24.9	23	69.7
25-29.9	5	15.2
≥30	1	3

Child Feeding Practices Scale: Reliability

The criterion validity of the Comprehensive Feeding Practices Questionnaire (32) was previously verified by identifying significant correlations between food as a reward and pressure and between teaching about nutrition and modeling. Additionally, significant correlations were found between teaching about nutrition and balance and variety and between modeling and balance and variety (32). Internal consistency reliability for the original CFPQ subscales was demonstrated by Cronbach's α of 0.58 for encourage balance and variety (4), 0.69 for food as a reward (3), 0.80 for modeling (4), 0.79 for pressure (4), and 0.68 for teaching about nutrition (3). As the original CFPQ was validated in a sample of parents and item wording was modified for the present study, reliability was determined in our sample of early childhood education students. Cronbach's α was established at 0.57 for encourage balance and variety (4), 0.63 for food as a reward (3), 0.74 for modeling (4), 0.82 for pressure (4), and 0.26 for teaching about nutrition (3). One item in the teaching about nutrition subscale, "I tell children what to eat and what not to eat without explanation," was removed during data analysis because of inconsistency in responses adversely impacting reliability of the subscale. After removal, Cronbach's α for teaching about nutrition subscale was established as 0.74 (2). Cronbach's α for the overall scale was 0.76.

Nutrition Knowledge and Child Feeding Practices among Early Childhood Students

Mean overall score on the nutrition knowledge instrument was 64.9%. Students who had completed a practicum had the highest mean total score on the nutrition knowledge instrument.

However, no statistically significant differences in overall knowledge score were observed among students of varying practicum status (Table 2).

Table 2.
Nutrition Knowledge Among Early Childhood Education Students

	Score (Mean±SD)
Completed practicum (n=15)	68.08±7.97
Practicum in progress (n=9)	62.72±10.06
Have not started practicum (n=9)	61.77±10.49
Overall score (n=33)	64.9±9.46

Total nutrition knowledge scores among early childhood education students (n=33) by practicum status. Analysis of variance revealed no statistically significant differences in knowledge scores by practicum status ($p < 0.05$).

Figure 1 details nutrition knowledge score results by subsections of the instrument: dietary recommendations for preschool children, food placement in MyPyramid food groups, and nutrient and food source identification. Students had lowest scores on dietary recommendations (45.93±16.65%) compared to knowledge of food groups (74.14±13.22%) and dietary sources of nutrients (74.62±12.46%). Students who had completed a practicum scored 48.7% on the dietary recommendations subsection compared to 49.8% currently enrolled in a practicum and 37.5% among those who had not yet started their practicum. However, multivariate analysis revealed no significant differences in dietary recommendation scores by practicum status ($p=0.21$). Likewise, no statistically significant differences were found in other knowledge subsection scores by practicum status.

The means and standard deviations for child feeding practice scores in the sample as a whole is provided in Table 3. Early childhood students agreed most highly with encouraging balance and variety as well as modeling. Results of child feeding practices subscale scores by practicum status are presented in Figure 2. Multivariate analysis revealed that students who had not started a practicum would be more likely to use food as a reward compared to those who had completed a practicum. The modeling subscale score for those currently in a practicum fell in the intermediate range but did not differ significantly from the other two groups.

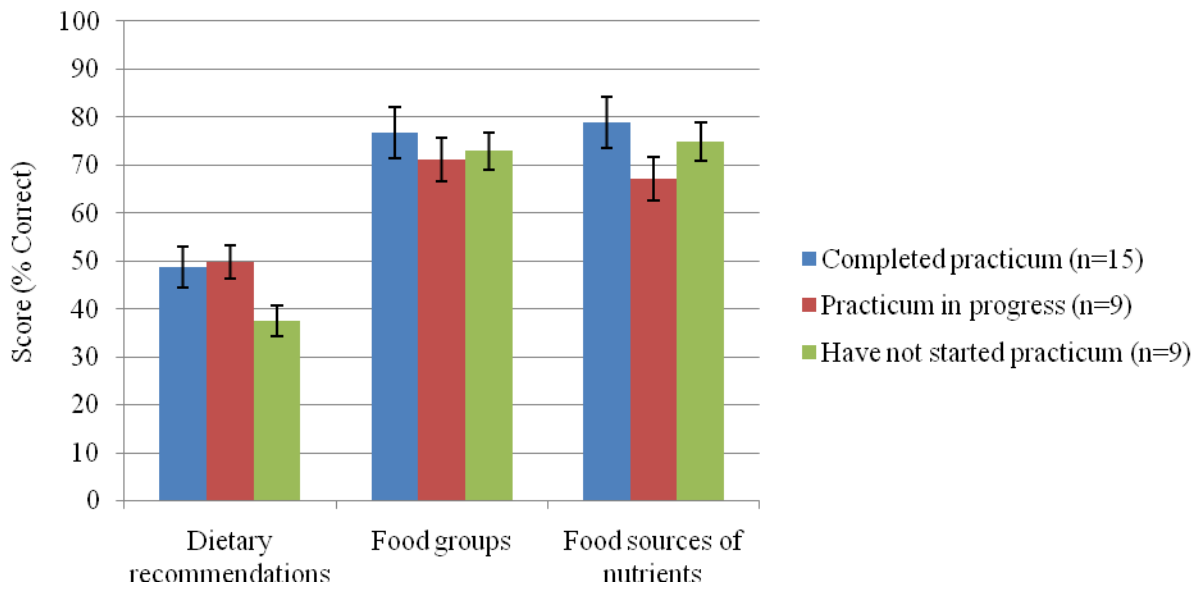

Figure 1. Nutrtion Knowledge Among Early Childhood Education Students.
Nutrition knowledge scores of early childhood education majors (n=33) by practicum status. Multivariate analysis showed no statistically significant differences by practicum status. Values shown are Mean ± SEM. $p < 0.05$

Table 3.

Child Feeding Practices Scores Among Early Childhood Education Students

	Score (Mean±SD)
Encourage balance and variety (n=33)	4.85±0.24
Food as reward (n=33)	2.52±1.00
Modeling (n=33)	4.55±0.59
Pressure (n=32)	3.09±1.01
Teaching about nutrition (n=32)	4.39±0.79

Mean child feeding practices scores on five select subscales of the modified Comprehensive Feeding Practices Questionnaire (Musher-Eizenman and Holub, 2007). (Ratings were from 1 = disagree to 5 = agree.)

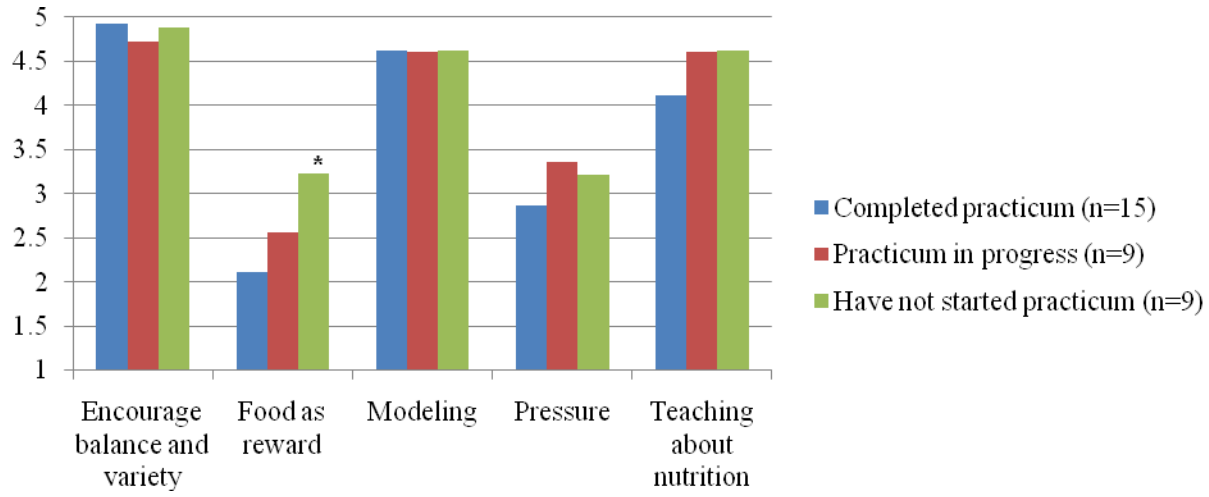

Figure 2. Child Feeding Practices Among Early Childhood Education Students.
Mean child feeding practices scores by practicum status of Early Childhood Education students (n=33). Multivariate analysis showed that students who have not started a practicum agreed with using food as a reward significantly more than students who had completed a practicum. *$p < 0.05$

Comparing Nutrition Knowledge and Child Feeding Practices

There were significant negative associations between modeling and both MyPyramid food group knowledge and total nutrition score. Additionally, pressure was inversely associated with knowledge of MyPyramid food groups. Table 4 shows results of correlation analysis between nutrition knowledge scores and child feeding practices subscale scores. There were no other significant correlations between the nutrition knowledge and child feeding subscale results.

Table 4. Correlations Between Nutrition Knowledge and Feeding Practices

	Dietary recommendations	Food groups	Food sources of nutrients	Total nutrition score
Encourage balance and variety (n=33)	-0.247	-0.077	0.149	-0.115
Food as reward (n=33)	0.185	-0.089	0.050	0.089
Modeling (n=33)	-0.206	-0.405*	-0.122	-0.363*
Pressure (n=32)	-0.037	-0.361*	-0.337	-0.336
Teaching about nutrition (n=32)	0.118	-0.052	-0.143	-0.020

Pearson product-moment correlation analysis was performed on the mean nutrition knowledge scores and the mean feeding practices scores to determine the extent to which there was a relationship between the variables. Modeling was inversely correlated with knowledge of MyPyramid food groups and total nutrition score. Pressure was found to be negatively correlated with knowledge of MyPyramid food groups. No other statistically significant correlations were found between the nutrition knowledge and child feeding practices subscales. *$p < 0.05$

Comparing Sample Characteristics with Nutrition Knowledge and Child Feeding Practices

Table 5 presents means and standard deviations for nutrition knowledge scores between students who had completed a nutrition course and those who had not. Students who had completed a nutrition course had higher mean scores on the food groups and food sources of nutrients subsections as well as total nutrition knowledge score. However, results from a t-test and a multivariate analysis revealed no statistically significant differences in nutrition knowledge by completion of a nutrition course. Similar to nutrition knowledge, multivariate analysis showed no statistically significant differences in child feeding practices subscale scores between students who completed a nutrition course and those who had not (Table 6). Analyses of variance tests also revealed no significant differences in nutrition knowledge scores or child feeding practices subscale scores across BMI of participants (results not shown).

Table 5.
Nutrition Knowledge and Completion of a Nutrition Course

	Course Completed	Score (Mean±SD)
Dietary recommendations	Yes (n=14)	43.4±4.5%
	No (n=19)	47.9±3.8%
Food groups	Yes (n=14)	79.3±3.4%
	No (n=19)	70.4±2.9%
Food sources of nutrients	Yes (n=14)	78.6±3.3%
	No (n=19)	71.7±2.8%
Total Score	Yes (n=14)	67.1±2.8%
	No (n=19)	63.3±1.9%

Nutrition knowledge scores of early childhood education majors (n=33) by completion of a college-level nutrition course. Multivariate analysis revealed no statistically significant differences in knowledge subsection scores ($p=0.12$) between those who had completed a course and those who had not. T-test showed no statistically significant differences for total score ($p=0.26$) between those who had completed a course and those who had not. No statistical significance at $p < 0.05$

Table 6.
Child Feeding Practices and Completion of a Nutrition Course

	Course Completed	Mean±SD
Encourage balance and variety	Yes (n=14)	4.86±0.07
	No (n=19)	4.85±0.06
Food as a reward	Yes (n=14)	2.49±0.29
	No (n=19)	2.56±0.25
Modeling	Yes (n=14)	4.54±0.13
	No (n=19)	4.65±0.11
Pressure	Yes (n=14)	2.86±0.28
	No (n=19)	3.22±0.24
Teaching about nutrition	Yes (n=14)	4.35±0.22
	No (n=19)	4.42±0.19

Child feeding practices scores of early childhood education majors (n=33) by completion of a college-level nutrition course. Multivariate analysis revealed no statistically significant differences between those who had completed a course and those who had not. No statistical significance at $p < 0.05$.

Discussion

Previous research has examined nutrition knowledge and child feeding practices of parents and limited research has reported on the same in child care providers (2-4, 6-7, 16-22). However, no previously published work has reported nutrition knowledge and child feeding practices of Early Childhood Education students in a university setting as related to nutrition coursework and practicum training. This is important because these students are future leaders in early childhood education, and as such are positioned to attain administrative positions and to develop policy related to early childhood education (34). Present findings indicate that Early Childhood Education students sampled know more about MyPyramid food groups and dietary sources of nutrients than they do about dietary intake recommendations for preschool-aged children. For example, 45.5% identified 2% fat milk the best milk choice for children ages 2-6, whereas only 18% correctly identified nonfat or 1% fat milk as the best choice as is recommended by the American Academy of Pediatrics (35). These findings are consistent with previous research that assessed overall knowledge of nutrition and knowledge of recommended dietary allowances among child care providers (21). Previous research assessing nutrition knowledge in medical students found that completion of a college-level nutrition course plays an important role in establishing basic knowledge of nutrition (36). Other courses that incorporate some nutrition curricula have been found to be less valuable in increasing nutrition knowledge compared to a course focusing solely on nutrition (36). Regardless, the possible contribution of a nutrition course to nutrition knowledge in the Early Childhood Education student population is not clear. In the present study, students who had completed a college-level course in nutrition had higher mean scores on the MyPyramid food groups (79.3%) and the food sources of nutrients subsections (78.6%) than students who had not completed a course in nutrition (70.4%

and 71.7%, respectively). However, these results were not statistically significant ($p = 0.12$). This suggests there may be a role for nutrition coursework in attainment of general nutrition knowledge content, but not in application of nutrition knowledge in the early childhood education setting. However, this will require further investigation with a larger study sample to confirm. Practicum training provides another potential mode for learning application of nutrition principles in the early childhood education setting. A nonsignificant relationship was observed in knowledge of dietary recommendations for preschoolers according to practicum status. Those who had completed their practicum scored 48.7%, compared to 49.8% for those with their practicum in progress, and 37.5% for those who had not started their practicum ($p = 0.21$). While nonsignificant, results suggest that students' knowledge about nutritional recommendations for young children may be enhanced during their practicum in early childhood education. Students may gain a better understanding of portion sizes that are appropriate for preschoolers, for example, by observing young children selecting and eating their own portions during a family-style meals. These preliminary findings, although not significant, suggest the need for further investigation with a larger study sample to determine whether knowledge of food groups and food sources of nutrients are enhanced by a college-level nutrition course, and whether knowledge of dietary recommendations for preschoolers may be more likely learned during the practicum in early childhood education.

Aside from Early Childhood Education students' knowledge about nutrition in young children, child feeding practices in this sample were also assessed. Results showed that Early Childhood Education students most highly agreed with and were more likely to report encouraging balance and variety when selecting foods at mealtime and to model dietary behaviors. Other studies have also reported that child care providers believed that dietary

modeling was an important and influential practice in shaping children's eating patterns and acceptance of foods (18, 21). It is paramount, however, that both child care providers and students not only perceive dietary modeling to be an influential practice but that they also translate these perceptions into positive and consistent behaviors that are modeled to children during mealtime.

Completion of a nutrition course was not related to reported child feeding practices in this study. However, practicum training may provide an important venue for learning appropriate child feeding practices. In this study, students who had not started a practicum agreed with using food as a reward significantly more than students who had completed a practicum, whereas those currently enrolled in a practicum fell in between. As in the knowledge of dietary recommendations for preschoolers, this suggests that students may learn to not use food for reward or punishment during their practicum training. Therefore, the practicum itself appears to be particularly important for applying nutrition along with traditional early education learning, such as child development or developmentally appropriate practices. Other evidence also suggests that practicum experience and coursework are both important in best preparing Early Childhood Education students to enter the workforce (37-38).

The observed relationships between nutrition knowledge and child care feeding practices are more difficult to interpret. Modeling was found to be significantly and negatively associated with knowledge of MyPyramid food groups and total nutrition knowledge score, meaning that students who were more likely to report modeling had lower MyPyramid food group and overall nutrition knowledge scores. One potential explanation for this finding is that most of the students highly agreed with modeling, thus the modeling score may have been so high that the

inverse correlation with food group knowledge, while present, is not of practical importance. In addition, using pressure as a child feeding practice was found to be negatively associated with knowledge of MyPyramid food groups. Thus, students who had greater knowledge of MyPyramid food groups were less likely to report pressuring children to eat. Knowledge of dietary sources of nutrients and total nutrition knowledge score were also found to be negatively correlated with using pressure as a feeding practice. No other significant associations were found between the nutrition knowledge and child feeding subscale results. This contrasts with Nahikian-Nelms (16) findings of positive correlations between nutrition knowledge and child feeding practices in a sample of 113 child care providers. The small sample size in the present study may be a factor.

No significant differences in child feeding practices scores were found in relation to completion of a college-level nutrition course. These findings suggest that college-level nutrition courses may not play a role in helping Early Childhood Education students to develop positive eating habits in young children through the use of appropriate feeding practices. Perhaps, the early childhood education practicum is more pivotal in helping students learn to avert negative child feeding practices such as using food as a measure of reward and punishment for young children.

While some research exists on the nutrition knowledge and child feeding practices of both parents and child care providers (2-4, 6-7, 16-22), the major strength of the current study is that it represents a significant preliminary step in examining nutrition knowledge and child feeding practices of Early Childhood Education students and adds to the body of literature on child care feeding practices. An additional strength is the nutrition knowledge instrument that

was developed specifically for this study. Other nutrition knowledge instruments have been created and previously validated in other populations (30-31). Prior to development of this instrument, however, no nutrition knowledge instrument had been developed or validated specifically pertaining to early childhood education students. Content validity of the nutrition knowledge instrument was established through expert panel review. In addition, construct validity was established by administering a pilot study and comparing scores of early childhood education majors to scores of nutrition majors. Furthermore, internal consistency validity was determined by establishing Cronbach's alpha for each subsection of the nutrition knowledge instrument. Additionally, the Comprehensive Feeding Practices Questionnaire (CFPQ) (32) which was used to measure child feeding practices of Early Childhood Education students, was adapted from a previously validated instrument. Internal consistency reliability was also determined for the modified CFPQ by establishing Cronbach's alpha for each subscale. The sample of early childhood education students was also a relatively geographically diverse sample with students residing in each of the four U.S. regions: northeast, midwest, south, and west.

Limitations of this study included first the small and relatively homogenous sample size which could make it difficult to detect differences in nutrition knowledge or child feeding practices scores across participant characteristics that could be revealed in a larger study. Second, the nutrition knowledge instrument has not been validated in a larger study. In addition, while the Comprehensive Feeding Practices Questionnaire (32) was adapted from a previously validated instrument, the original CFPQ was validated in parents. Furthermore, child feeding practices were assessed by self report rather than direct observation. While students may believe that certain feeding practices have a positive influence on children, this study is limited by the

fact that only direct observation would reveal if students translate their beliefs into positive behaviors during mealtime.

Despite these limitations, the current study provides important preliminary information about the nutrition knowledge and reported child care feeding practices of Early Childhood Education students, and more importantly contributes to the literature focusing on child care providers' nutrition knowledge and child feeding practices as well as their great potential to shape children's eating behaviors. This research identified the areas where nutrition knowledge needs strengthening, and it identified child feeding practices in Early Childhood Education students. It also suggests roles for both nutrition coursework and practicum training in optimizing nutrition knowledge and child feeding practices among future leaders in early childhood education. Future research should further examine the areas in which Early Childhood Education students are receiving their training about nutrition and child feeding practices. Larger studies examining a more diverse sample of Early Childhood Education students are also needed to more clearly identify nutrition knowledge and child feeding practices in this particular population. Further exploration into the role of practicum training for the learning and development of positive child feeding practices is also needed to more clearly understand the impact of practicum training on Early Childhood Education students' child feeding practices.

References

1. Branen L, Fletcher J. Comparison of college students' current eating habits and recollections of their childhood food practices. *J Nutr Educ* 1999;31:304-310.

2. Hoerr SL, Hughes SO, Fisher JO, Nicklas TA, Liu Y, Shewchuk RM. Associations among parental feeding styles and children's food intake in families with limited incomes. *Int J Behav Nutr Phys Act.* 2009;6:55.

3. Hughes SO, Power TG, Fisher JO, Mueller S, Nicklas TA. Revisiting a neglected construct: parenting styles in a child-feeding context. *Appetite.* 2005;44:83-92.

4. Zeinstra GG, Koelen MA, Kok FJ, Van der Laan N, Graaf CD. Parental child-feeding strategies in relation to Dutch children's fruit and vegetable intake. *Public Health Nutr.* 2009;22:1-10.

5. Baumrind D. Current patterns of parental authority. *Developmental Psychology Monograph, Part 2.* 1971;4:1-103.

6. Hubbs-Tait L, Kennedy TS, Page M, Topham GL, Harrist AW. Parental feeding practices predict authoritative, authoritarian, and permissive parenting styles. *J Am Diet Assoc.* 2008;108:1154-1161.

7. Patrick H, Nicklas TA, Hughes SO, Morales M. The benefits of authoritative feeding style: caregiver feeding styles and children's food consumption patterns. *Appetite.* 2005;44:243-249.

8. Fisher JO, Mitchell DC, Smicklas-Wright H, Birch LL. Parental influences on young girls' fruit and vegetable, micronutrient, and fat intakes. *J Am Diet Assoc.* 2002;102:58-64.

9. Munsch S, Hasenboehler K, Michael T, Meyer AH, Roth B, Biedert E, Margraf J. Restrained eating in overweight children: Does eating style run in families? *Int J Pediatr Obes.* 2007;2:97-103.

10. Tibbs T, Haire-Joshu D, Schechtman KB, Brownson RC, Nanney MS, Houston C, Auslander W. The relationship between parental modeling, eating patterns, and dietary intake among African-American parents. *J Am Diet Assoc.* 2001;101:535-541.

11. Stanek K, Abbott D, Cramer S. Diet quality and the eating environment of preschool children. *J Am Diet Assoc*. 1990;90:1582-1584.

12. Burgess-Champoux TL, Larson N, Neumark-Sztainer D, Hannan PJ, Story M. Are family meal patterns associated with overall diet quality during the transition from early to middle adolescence? *J Nutr Educ Behav.* 2009;41:79-86.

13. United States Department of Labor. Bureau of Labor Statistics: Mothers in the Labor Force by Age of Child, 1975-2006. 2006. http://mchb.hrsa.gov/chusa07/popchar/pages/106wmcc.html. Accessed November 9, 2009.

14. Federal Interagency Forum on Child and Family Statistics. America's Children National Indicators of Well-being 2002. 2005. http://www.childstats.gov/americaschildren/tables/fam3b.asp. Accessed November 8, 2009.

15. US Census Bureau. Who's Minding the Kids? Child Care Arrangements: Winter 2002. 2005. http://www.census.gov/prod/2005pubs/p70-101.pdf. Accessed November 8, 2009.

16. Hughes SO, Patrick H, Power T, Fisher JO, Anderson CB, Nicklas TA. The impact of child care providers' feeding on children's food consumption. *J Dev Behav Pediatr.* 2007;28:100-107.

17. Hendy HM. Comparison of five teacher actions to encourage children's new food acceptance. *Ann Behav Med.* 1999;21(1):20-26.

18. Hendy HM, Raudenbush B. Effectiveness of teacher modeling to encourage food acceptance in preschool children. *Appetite*. 2000;34:61-76.

19. Addessi E, Galloway AT, Visalberghi E, Birch LL. Specific social influences on the acceptance of novel foods in 2-5-year-old children. *Appetite*. 2005;45:264-271.

20. Sigman-Grant M, Christiansen E, Branen L, Fletcher J, Johnson SL. About Feeding Children: Mealtimes in child-care centers in four western states. *J Am Diet Assoc.* 2008;108:340-346.

21. Nahikian-Nelms M. Influential factors of caregiver behavior at mealtime: a study of 24 child-care programs. *J Am Diet Assoc*. 1997;97:505-509.

22. Dunn C, Thomas C, Ward D, Pegram L, Webber K, Cullitan C. Design and Implementation of a Nutrition and Physical Activity Curriculum for Child Care Settings. *Prev Chronic Dis*. 2006;3(2):1-8.

23. SPSS. (2010). mrInterview (Standard) (Version 5.5). Chicago, IL: SPSS Ltd.

24. SPSS. (2010). SPSS 17.0 for Windows. Chicago, IL: SPSS Inc.

25. United States Department of Agriculture. Dietary Guidelines for Americans 2005. 2005. http://www.health.gov/dietaryguidelines/dga2005/document/pdf/DGA2005.pdf. Accessed December 7, 2009.

26. Food and Nutrition Board. Dietary Reference Intakes. 2004. http://iom.edu/en/Global/News%20Announcements/~/media/Files/Activity%20Files/Nutrition/DRIs/DRISummaryListing2.ashx. Accessed December 7, 2009.

27. United States Department of Agriculture. MyPyramid.gov. 2009. http://www.mypyramid.gov/preschoolers/index.html. Accessed December 7, 2009.

28. United States Department of Health and Human Services. Healthy People 2010 Objectives: Nutrition and Weight Status. 2009. http://www.healthypeople.gov/hp2020/Objectives/TopicArea.aspx?id=35&TopicArea=Nutrition+and+Weight+Status. Accessed December 7, 2009.

29. Parmer SM, Salibury-Glennon J, Shannon D, Struempler B. School gardens: An experiential learning approach for a nutrition education program to increase fruit and vegetable knowledge, preference, and consumption among second-grade students. *J Nutr Educ Behav*. 2009;41:212-217.

30. Struempler BJ, Raby A. Pizza Please: An interactive nutrition evaluation for second and third grade students. *J Nutr Educ Behav*. 2005;37:94-95.

31. Parmenter K, Wardle J. Development of a general nutrition knowledge questionnaire for adults. *Eur J Clin Nutr*. 1999;53:298-308.

32. Musher-Eizenman D, Holub A. Comprehensive Feeding Practices Questionnaire: Validation of a New Measure of Parental Feeding Practices. *J Pediatr Psych*. 2007;32(8):960-972.

33. Van Strien T, Frijters JER, Bergers GPA, Defares PB. Dutch Eating Behavior Questionnaire. *Int J Eat Disord.* 1986;5:295-315.

34. United States Department of Labor. Bureau of Labor and Statistics: Child Care Workers. 2009. Available at: http://www.bls.gov/oco/ocos170.htm. Accessed: December 4, 2009.

35. Greer FR, Krebs NF, Committee on Nutrition. Optimizing bone health and calcium intakes of infants, children, and adolescents. *Pediatrics*. 2006;117(2):578-585.

36. Morgan SL, Weinsier RL, Boker JR, Brooks CM. Nutrition education for medical students: evaluation of the relative contribution of freshman courses in biochemistry and nutrition to performance on a standardized examination in nutrition. *Nutrition* 1989;5(1):31-36.

37. Early DM, Winton PJ. Preparing the workforce: early childhood teacher preparation at 2- and 4-year institutions of higher education. *Early Child Res Q.* 2001;16(3):285-306.

38. Jacobs GM. Providing the scaffold: a model for early childhood/primary teacher preparation. *Early Child Educ J* 2001;2:125-130.

Conclusion

Overall, this research provides significant preliminary information about the nutrition knowledge and reported child feeding practices of Early Childhood Education students, and more importantly contributes to the body of literature on child care provider' nutrition knowledge and child feeding practices. While this study indentified areas where students' nutrition knowledge needs strengthening, it also suggests roles for both nutrition coursework and practicum training in optimizing students' nutrition knowledge and child feeding practices. Future research should further explore the areas in which Early Childhood Education students are receiving their training about nutrition and child feeding practices.

Appendix

Expanded Methodology

Introduction

This study described the nutrition knowledge and child feeding practices in a population of Early Childhood Education students, and assessed the relationship of practicum status on nutrition knowledge and feeding practices. Specifically, this research:

1. Described the nutrition knowledge and child care feeding practices among students enrolled in Early Childhood Education programs.
2. Determined the extent to which there is a relationship between nutrition knowledge and child care feeding practices.
3. Determined the extent to which there is a relationship between nutrition knowledge and child care feeding practices with completion of a college-level nutrition course.
4. Determined the extent to which there is a relationship between nutrition knowledge and child care feeding practices with completion of a practicum in Early Childhood Education.

Brief methodologies were provided in Part II of this thesis. The following is an in-depth look at the methodology for completing this project. An overview of the expert panel feedback and the *Nutrition Knowledge of Early Childhood Education Students: Pilot for Validation of a Survey Instrument* pilot study is provided, followed by description of the methods used in the thesis.

Research Design and Methods

Survey Instrument Review and Validation: Expert Panel

The nutrition knowledge survey instrument was reviewed by an expert panel to establish content validity. The expert panel consisted of four registered dietitians with advanced degrees and experience and expertise pertaining to early childhood nutrition. These dietitians provided valuable insight into the types of questions and content included in the instrument. A professor in early childhood education also reviewed the survey instrument and provided insight about appropriateness of the survey content for early childhood students. The survey was sent via an email attachment directly to these experts and feedback was collected. Survey evaluation forms with specific questions regarding various aspects of the survey instrument were sent to the expert panel participants (Appendix). The survey evaluation form addressed the following items: the importance, accuracy, sequence, and number of included nutrition knowledge questions; the understandability, appropriateness, and pertinence of the demographic questions; the appropriateness of the Comprehensive Feeding Practices Questionnaire to measure feeding practices utilized by students in early childhood education; and the understandability and readability of the overall survey instrument.

Overall, expert panelists felt that the level of readability was appropriate for students in early childhood education. Additionally, panelists agreed that the instructions and transitions were clear, concise, and helpful to potential participants. Specifically pertaining to the nutrition knowledge section, panelists agreed that the number and sequence of knowledge questions were appropriate. Positive feedback pertaining to the knowledge section included the focus on the selected topic areas: dietary recommendations for preschool children, food placement in

MyPyramid food groups, and nutrient and source identification. Panelists recommended improvements pertaining to the specificity of particular questions regarding dietary recommendation and/or MyPyramid food groups. Following expert panel feedback, modifications to particular questions and answer choices were made prior to administering the pilot survey.

Nutrition Knowledge of Early Childhood Education Students: Pilot for Validation of a Survey Instrument

The purpose of this pilot study was to validate the nutrition knowledge section of the survey instrument. By identifying items that were answered correctly or incorrectly by more than 80% of early childhood education majors and by analyzing the correlation between the individual items and total score, researchers modified the survey instrument to increase the instrument's validity. The survey and pilot study were approved by the University of Tennessee Institutional Review Board.

Pilot Subjects

Recruitment of early childhood students at the University of Tennessee occurred by sending an email to the Early Childhood Education Internship Coordinators, who then forwarded the survey to all graduating seniors in the program. Nutrition majors at the University of Tennessee also received the survey via an email from the director of the Didactic Program in Dietetics in order to establish construct validity. The survey email contained directions for

completing the survey and the survey web address. Internship coordinators and the director of the Didactic Program in Dietetics were asked to forward a follow-up email reminder five calendar days after sending the initial survey email. This test yielded 10 out of 28 responses from students majoring in Early Childhood Education (Table 6). Twenty out of 40 nutrition majors responded. Therefore, a total of 68 students were invited to participate in the study with a response rate of 30 students (44%).

Table 7.
Pilot Study Sample[1]

	N	Percentage
Early Childhood Education students	10	33%
Nutrition students	20	66%

[1]Total n = 30

Pilot Results

Early childhood education students scored an average total nutrition knowledge score of 59.5%, while the total score for nutrition students was 74.4% (Figure 4). Comparison of the students' scores for the dietary recommendations subsection indicated no significant differences between the groups. There were significant differences in both the food groups and the food sources subsections. Internal consistency reliability for the nutrition knowledge subsections was established by Cronbach's alpha of .77 for dietary recommendations, .74 for food groups, and .85 for food sources of nutrients. Based on the pilot results, one item from the dietary recommendations subsection was removed in order to increase internal consistency reliability. Additional modifications included restructuring the format of particular questions and rewording specific items to increase understandability.

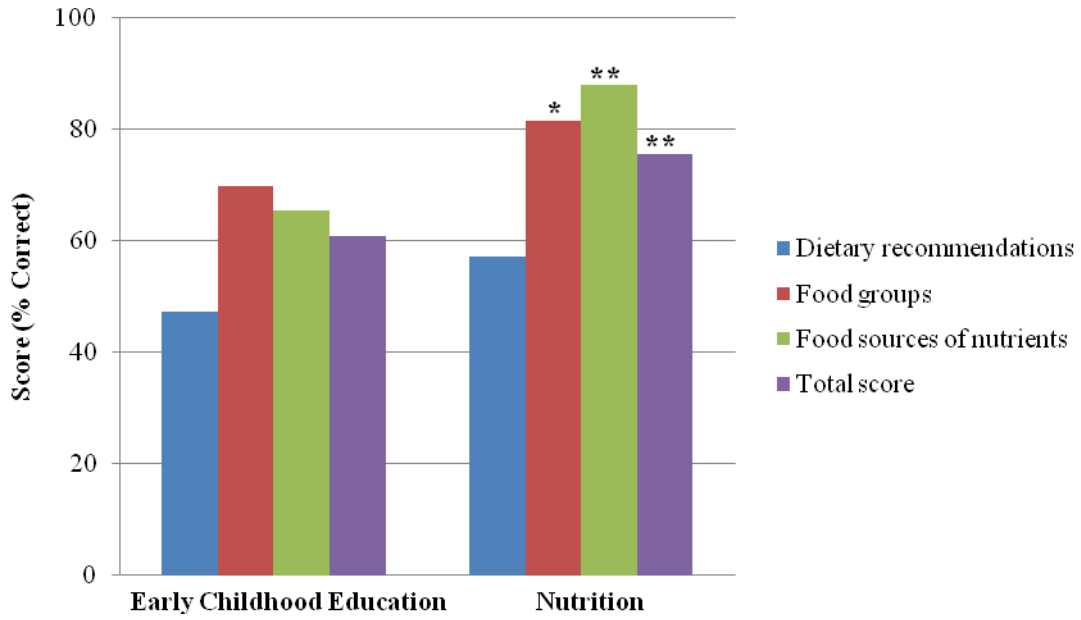

Figure 3. Assessment of Construct Validity (N=30). [a] Comparing nutrition knowledge scores of early childhood majors compared with nutrition majors *p < 0.05. **p < 0.001

Survey of Child Feeding Practices

Dear student,

Researchers at the University of Tennessee-Knoxville are interested in learning more about your nutrition knowledge and child feeding practices in the early childhood education setting. The following survey is divided into three sections: 1) knowledge of nutrition; 2) child feeding practices in the early childhood setting; and 3) demographic information. The survey should take less than 20 minutes to complete.

Participation in this research study is strictly voluntary and you may refuse to participate or to answer any questions at any time with no penalty. There are no risks involved in your participation. Your responses are anonymous. While you have the option to enter your email address at the end of the survey to be entered in a random drawing for two $25 Target or Wal-Mart gift cards (winner's choice) all identifying information will be deleted before survey results are analyzed. Please note that entering the drawing is voluntary and the survey can be completed without doing so.

If you have any questions at any time about the survey you may contact the researcher Melissa Hansen-Petrik, Ph.D, R.D., LDN at the Nutrition Department at the University of Tennessee, 1215 West Cumberland Ave. Room 229, Knoxville, TN 37996-1920, and 865-974-6264. If you have questions about your rights as a participant, contact the Office of Research Compliance Officer at 865-974-7697.

By clicking "yes" below, you are providing your consent to participate in the study.

___ Yes, I agree to participate in this survey and research study.
___ No, I do not agree to participate in this survey and research study.

The first section contains questions about nutrition for preschool-aged children. Please choose the best response(s) to the following questions. If you are unsure about an answer, please make your best guess.

1) For preschool-aged children, how many grains eaten should be whole grains?

   a) All grains eaten by children should be whole grains

   b) Half of grains eaten by children should be whole grains

   c) One-fourth of grains eaten by children should be whole grains

   d) Eating whole grains is optional for the health of children

2) Approximately how many cups of vegetables should preschool-aged children consume each day?

   a. ½ cup

   b. 1 cup

   c. 2 cups

   d. 3 cups

3) Which of these portions of fruit counts as one cup of fruit from the MyPyramid fruit group?

	Yes	No
a. 1 small apple	X	
b. 3 strawberries		X
c. ½ cup dried fruit	X	
d. 2 bananas		X

4) Approximately how many ounces of meat or other protein food should preschool-aged children consume each day?

   a. 0 to 1 ounce

   b. 2 to 3 ounces

   c. 4 to 5 ounces

   d. 6 to 7 ounces

5) What is the recommended amount from the milk group that preschoolers should consume per day? This includes milk and equivalent foods such as yogurt, soy milk, or rice milk.

   a. 1 cup of milk or equivalent

   b. 2 cups of milk or equivalent

   c. 3 cups of milk or equivalent

   d. 4 cups of milk or equivalent

6) Approximately how many cups of fruit should preschool-aged children consume per day?

   a. ¼ to ½ cup

   b. 1 to 1 ½ cups

   c. 2 to 2 ½ cups

   d. 3 cups

7) What is the best milk choice for children ages 2-6?

a. Non-fat (skim) or 1% milk

b. 2% milk

c. Whole milk

d. All of the above are equally good choices

8) The Dietary Guidelines for Americans defines five vegetable subgroups. Which of the following are among the defined subgroups?

	Yes	No
a. Dark green vegetables	X	
b. Cruciferous vegetables		X
c. Dried beans and peas	X	
d. Root vegetables		X
e. Starchy vegetables	X	
f. Orange vegetables	X	

9) Which of these foods count as part of the MyPyramid fruit group?

	Yes	No
a. Canned peaches	X	
b. Mangoes	X	
c. 100% fruit juice	X	
d. Raisins	X	
e. Fruit-flavored beverages such as Hi-C or Kool-Aid		X

10) Vegetables are categorized into sub-groups based on their nutrient content. Which of these are categorized in the dark green vegetable group?

	Yes	No
a. Green beans		X
b. Cucumbers		X
c. Broccoli	X	
d. Zucchini		X
e. Spinach	X	

11) Which ones of the following foods are whole grains?

	Yes	No
a. Oatmeal	X	
b. Pretzels		X
c. Elbow macaroni		X
d. Brown rice	X	
e. White bread		X

12) Which of these foods counts as part of the MyPyramid milk group?

	Yes	No
a. Frozen yogurt	X	
b. Cottage cheese	X	
c. 2% milk	X	
d. Lactose free milk	X	

13) Which one of the following is not included as a food group in MyPyramid?

a. Grains
b. Oils
c. Sweets
d. Meat and Beans
e. All of the above are included as food groups in MyPyramid

14) Which of these foods are included in the MyPyramid meat and bean group?

	Yes	No
a. Almonds	X	
b. Turkey breast	X	
c. Eggs	X	
d. Tuna	X	
e. Lentils	X	
f. Pork chops	X	

15) Preschool children require approximately 10 mg of iron per day. Which one of these foods provides the best source of iron?

a. Fortified cereal
b. Apple
c. Corn
d. Orange juice

16) The intake of fiber in preschool children may also be of concern. Which one of these foods provides the best source of fiber?

a. Milk

b. Eggs

c. Orange

d. Sausage

17) Preschool-aged children require about 500-800 milligrams of calcium per day. Which of these foods are good sources of calcium?

	Yes	No
a. Watermelon		X
b. Non-fat milk	X	
c. Chicken		X
d. Cantaloupe		X
e. Provolone cheese	X	

18) High intakes of sodium in preschool children are of concern. Which of these foods are high in sodium?

	Yes	No
a. Instant pudding	X	
b. Ham	X	
c. Reduced-fat yogurt		X
d. Canned ravioli	X	

19) Lean sources of dietary protein are recommended for preschool-aged children. Which one of these foods is a lean or low-fat source of protein?

a. Bologna

b. Fish sticks

c. Hot dog

d. Tuna

e. Chicken nuggets

20) Potassium is a particular nutrient of concern for preschool children. Which one of these foods provides the best source of potassium?

a. White bread

b. Chicken breast

c. Apple

d. Baked potato

21) It is recommended that most of the fats in the diet of preschool children come from monounsaturated and polyunsaturated fats. Which one of these foods provides the best source of monounsaturated and polyunsaturated fats?

a. Chopped walnuts

b. Whole milk

c. Biscuit

d. Cheddar cheese

22) Which of these foods are good protein sources?

	Yes	No
a. Lentils or other dried beans	X	
b. Fruit		X
c. Potatoes		X
d. Fish	X	

The next section contains questions about your child feeding practices in the early childhood setting. Please choose the response that most closely aligns with your current practices. If you are not currently in an environment where you are involved with child feeding, please answer according to your most recent practices. If you have not been involved in child feeding at any time, answer according to what you would do in that situation.

23) I encourage children to eat healthy foods before unhealthy ones.

a. Disagree
b. Slightly disagree
c. Neutral
d. Slightly agree
e. Agree

24) I encourage children to try new foods.

a. Disagree
b. Slightly disagree
c. Neutral
d. Slightly agree
e. Agree

25) I tell children that healthy food tastes good.

a. Disagree
b. Slightly disagree
c. Neutral
d. Slightly agree
e. Agree

26) I encourage children to eat a variety of foods.

a. Disagree
b. Slightly disagree
c. Neutral
d. Slightly agree
e. Agree

27) I offer sweets (candy, ice cream, cake, pastries) to children as a reward for good behavior.

a. Disagree
b. Slightly disagree
c. Neutral
d. Slightly agree
e. Agree

28) I withhold sweets/dessert from children in response to bad behavior.

a. Disagree
b. Slightly disagree
c. Neutral
d. Slightly agree
e. Agree

29) I offer children their favorite foods in exchange for good behavior.

a. Disagree
b. Slightly disagree
c. Neutral
d. Slightly agree
e. Agree

30) I model healthy eating for children by eating healthy foods myself.

a. Disagree
b. Slightly disagree
c. Neutral
d. Slightly agree
e. Agree

31) I try to eat healthy foods in front of children, even if they are not my favorite.

a. Disagree
b. Slightly disagree
c. Neutral
d. Slightly agree
e. Agree

32) I try to show enthusiasm about eating healthy foods.

a. Disagree
b. Slightly disagree
c. Neutral
d. Slightly agree
e. Agree

33) I show children how much I enjoy eating healthy foods.

a. Disagree
b. Slightly disagree
c. Neutral
d. Slightly agree
e. Agree

34) A child should always eat all of the food on his/her plate.

a. Disagree
b. Slightly disagree
c. Neutral
d. Slightly agree
e. Agree

35) If a child says, “I’m not hungry,” I try to get him/her to eat anyway.

a. Disagree
b. Slightly disagree
c. Neutral
d. Slightly agree
e. Agree

36) If a child eats only a small helping, I try to get him/her to eat more.

a. Disagree
b. Slightly disagree
c. Neutral
d. Slightly agree
e. Agree

37) When he/she says he/she is finished eating, I try to get the child to eat one more (two more, etc.) bites of food.

a. Disagree
b. Slightly disagree
c. Neutral
d. Slightly agree
e. Agree

38) I discuss with children why it's important to eat healthy foods.

a. Disagree
b. Slightly disagree
c. Neutral
d. Slightly agree
e. Agree

39) I discuss with children the nutritional value of foods.

a. Disagree
b. Slightly disagree
c. Neutral
d. Slightly agree
e. Agree

40) I tell children what to eat and what not to eat without explanation.

a. Disagree
b. Slightly disagree
c. Neutral
d. Slightly agree
e. Agree

In the final section, we want to learn about your background and dietary habits. Please choose the responses that best describe you.

41) How many servings of fruit do you eat on a typical day?
    a. 4 or more
    b. 3
    c. 2
    d. 1
    e. Less than 1

42) How many servings of vegetables do you eat on a typical day?
    a. 4 or more
    b. 3
    c. 2
    d. 1
    e. Less than 1

43) How often do you typically drink sweetened drinks such as soft drinks or sweet tea?
    a. 3 or more times per day
    b. 2 times per day
    c. 1 time per day
    d. 5-6 times per week
    e. 3-4 times per week
    f. 1-2 times per week
    g. Less than once per week

44) How often do you typically eat in a fast-food restaurant?
    a. 3 or more times per day
    b. 2 times per day
    c. 1 time per day
    d. 5-6 times per week
    e. 3-4 times per week
    f. 1-2 times per week
    g. Less than once per week

45) How often do you refuse food or drink offered because you are concerned about your weight?
    a. Seldom
    b. Sometimes
    c. Often
    d. Very often

46) Do you deliberately eat less in order not to become heavier?
    a. Seldom
    b. Sometimes
    c. Often
    d. Very often

47) How often do you try not to eat between meals because you are watching your weight?
    a. Seldom
    b. Sometimes
    c. Often
    d. Very often

48) Do you take into account your weight with what you eat?
    a. Seldom
    b. Sometimes
    c. Often
    d. Very often

49) What is your major?

    a. Early childhood education

    b. Elementary education

    c. Child development

    d. Other, please list: _____

    e. Other with early childhood certification

50) What is your area of certification?

a. Early childhood education, pre-kindergarten – 3rd grade
b. Early childhood education, pre-kindergarten – kindergarten
c. Dual certification, early childhood and special education
d. Elementary certification
e. Other _____

51) Have you completed a practicum in Early Childhood Education?

a. Completed practicum
b. Practicum in progress
c. Have not started practicum

52) Please choose your academic year in your current program:

a. Freshman
b. Sophomore
c. Junior
d. Senior
e. Graduate
f. Other: _____

53) What are your goals and plans after completion of your degree?

a. I plan to work in a child care center.

b. I plan to obtain an administrative position in a child care center.

c. I plan to develop policy related to child care.

d. I plan to work as an early childhood teacher (infant-kindergarten).

e. I plan to become an elementary school teacher.

f. Other, please list: _____

54) Which of the following best describes your education in nutrition:

a. I have completed a college-level nutrition course

b. I have not completed a college-level nutrition course, but took a course that included some nutrition. If so, please list: _____

c. I have not completed a college-level nutrition course, but will before graduation

d. I have not completed a college-level nutrition course, and have no plans to do so

e. Other _____

*(If answered **a** to question 54, complete question 55. If answered **b**, **c**, or **d** proceed to question 56). This will occur automatically in the online survey.*

55) Was the nutrition course required for graduation?

a. Yes

b. No

56) In which settings have you had child feeding responsibilities for children between the ages of 2 and 6? Choose all that apply:

a. I have been a nanny and/or babysitter

b. I have worked in a child care facility

c. I have worked and/or completed practicum experience at the child development laboratory at my college/university

d. I have been involved in the feeding of a younger sibling or siblings

e. I have children of my own

f. Other: _____

g. None

If respond "d" to above question, link to next question in electronic survey. Otherwise skip.

57) How many children do you have?

a. One

b. Two

c. Three

d. Four

e. More than four

58) Are you male or female?

a. Male

b. Female

59) What is your age? ____

60) What is your ethnic origin?

a. White, non-Hispanic
b. Black, non-Hispanic
c. Hispanic
d. Asian or Pacific Islander
e. American Indian, Alaskan Native, or Hawaiian Native
f. Other _____

61) What is your height to the nearest inch? *(drop down list in electronic format)*

a. 5’0”
b. 5’1”
c. 5’2”
d. 5’3”
e. 5’4”
f. 5’5”
g. 5’6”
h. 5’7”
i. 5’8”
j. 5’9”
k. 5’10”
l. 5’11”
m. 6’0”
n. 6’1”
o. 6’2”
p. Other _____

62) What is your weight to the nearest pound?

____ pounds

63) In which state do you currently reside? (*Drop down list of states*)

Alabama

Alaska

Arizona

Arkansas

California

Colorado

Connecticut

Delaware

Florida

Georgia

Hawaii

Idaho

Illinois

Indiana

Iowa

Kansas

Kentucky

Louisiana

Maine

Maryland

Massachusetts

Michigan

Minnesota

Mississippi

Missouri

Montana

Nebraska

Nevada

New Hampshire

New Jersey

New Mexico

New York

North Carolina

North Dakota

Ohio

Oklahoma

Oregon

Pennsylvania

Rhode Island

South Carolina

South Dakota

Tennessee

Texas

Utah

Vermont

Virginia

Washington

Washington DC

West Virginia

Wisconsin

Wyoming

Please enter your email address if you would like to be included in a drawing for your choice of a $25 Target or Wal-Mart gift card. _____

Thank you for your participation in the survey!

Nutrition Knowledge and Child Care Feeding Practices Survey
Evaluation Form

	Strongly agree	**Agree**	**Neither agree nor disagree**	**Disagree**	**Strongly disagree**
Introduction					
The survey introduction was clear, concise, and included all pertinent information for potential participants.					
Nutrition Knowledge					
Questions address nutrition knowledge areas that are most important for early childhood educators.					
Results of the nutrition knowledge section will accurately reflect the nutrition knowledge level of respondents.					
The sequence of nutrition questions is appropriate.					
The nutrition knowledge section needs more questions.					
The nutrition knowledge section needs fewer questions.					
Comprehensive Feeding Practices Questionnaire					
This validated survey instrument, as modified, is an appropriate measure of feeding practices utilized by students in early childhood education.					

Demographic Data					
Demographic questions are easy to understand.					
Demographic questions include all the appropriate response options.					
Demographic questions are worded in a manner that will be acceptable to respondents.					
Demographic questions address the most important characteristics for the purpose of this project.					
General format					
The survey is an appropriate length.					
The level of readability of the survey is appropriate for students in early childhood education.					
The transitions between sections are easy to understand.					
The transitions between sections are helpful in leading participants through the survey.					

Please describe any positive aspects of the survey instrument.

Please describe any negative aspects of the survey instrument.

The nutrition knowledge section includes questions on: 1) Dietary recommendations for preschool children; 2) Food placement in MyPyramid food groups and 3) Nutrient and source identification. Are there other content areas that should also be considered for inclusion? If so, please describe.

Are there any questions in the Nutrition Knowledge section that should be removed or modified? If so, please detail your recommendations here or on the survey instrument itself using the "track changes" feature.

Are there any content areas or questions that should be added to the Nutrition Knowledge section? If so, please detail your recommendations here or on the survey instrument itself using the "track changes" feature.

Additional comments/suggestions to improve the survey instrument:

Table 8. Early Childhood Education Students' Responses to Nutrition Knowledge Items: Dietary Recommendations (n=33)

Dietary Recommendations: Question	Answer Choices	% Answering
For preschool-aged children how many grains eaten should be whole grains?	All grains eaten by children should be whole grains	45.5
	Half of grains eaten by children should be whole grains	**48.6**
	One-fourth of grains eaten by children should be whole grains	6.1
	Eating whole grains is optional for the health of children	0
Approximately how many cups of vegetables should preschool-aged children consume each day?	1/2 cup	12.1
	1 cup	39.4
	2 cups	**33.3**
	3 cups	15.2
Which of these portions of fruit counts as one cup of fruit from the MyPyramid fruit group?	**1 small apple**	**82.8**
	3 strawberries	57.6
	1/2 cup dried fruit	**54.5**
	2 bananas	51.5
Approximately how many ounces of meat or other protein food should preschool-aged children consume each day?	0 to 1 ounce	6.1
	2 to 3 ounces	**54.5**
	4 to 5 ounces	36.4
	6 to 7 ounces	3.0
What is the recommended amount from the milk group that preschoolers should consume per day? This includes milk and equivalent foods such as yogurt, soy milk, or rice milk.	1 cup of milk or equivalent	9.1
	2 cups of milk or equivalent	**36.4**
	3 cups of milk or equivalent	42.4
	4 cups of milk or equivalent	12.1
Approximately how many cups of fruit should preschool-aged children consume per day?	1/4 to 1/2 cup	6.1
	1 to 1 1/2 cups	**54.5**
	2 to 2 1/2 cups	36.4
	3 cups	3.0
What is the best milk choice for children ages 2-6?	**Non-fat (skim) or 1% milk**	**18.2**
	2% milk	45.5
	Whole milk	30.3
	All of the above are equally good choices	6.1
The Dietary Guidelines for Americans defines five vegetable subgroups. Which of the following are among the defined subgroups?	**Dark green vegetables**	**100.0**
	Cruciferous Vegetables	54.5
	Dried beans and peas	**48.5**
	Root vegetables	30.3
	Starchy Vegetables	**75.8**
	Orange Vegetables	**54.5**

Table 9. Early Childhood Education Students' Responses to Nutrition Knowledge Items: Food Groups (n=33)

Food Groups: Question	Answer Choices	% Answering
Which of these foods count as part of the MyPyramid fruit group?	**Canned peaches**	**51.5**
	Mangoes	**100.0**
	100% fruit juice	**66.7**
	Raisins	**97.0**
	Fruit-flavored beverages such as Hi-C or Kool-Aid	100
Vegetables are categorized into sub-groups based on their nutrient content. Which of these are categorized in the dark green vegetable group?	Green beans	48.5
	Cucumbers	78.8
	Broccoli	**87.9**
	Zucchini	66.7
	Spinach	**97.0**
Which ones of the following foods are whole grains?	**Oatmeal**	**90.9**
	Pretzels	87.9
	Elbow macaroni	93.9
	Brown rice	**90.9**
	White bread	97.0
Which of these foods counts as part of the MyPyramid milk group?	**Frozen yogurt**	**57.6**
	Cottage cheese	**81.8**
	2% milk	**97.0**
	Lactose free milk	**54.5**
Which one of the following is not included as a food group in MyPyramid?	Grains	0
	Oils	18.2
	Sweets	**45.5**
	Meat and Beans	0
	All of the above are included as food groups in MyPyramid	36.4
Which of these foods are included in the MyPyramid meat and bean group?	**Almonds**	**48.5**
	Turkey breast	**97.0**
	Eggs	**57.6**
	Tuna	**81.8**
	Lentils	**75.8**
	Pork chops	**93.9**

Table 10. Early Childhood Education Students' Responses to Nutrition Knowledge Items: Nutrient Food Source Identification (n=33)

Food Sources of Nutrients: Question	Answer Choices	% Answering
Preschool children require approximately 10 mg of iron per day. Which one of these foods provides the best source of iron?	**Fortified cereal**	**63.6**
	Apple	24.2
	Corn	3.0
	Orange juice	9.1
The intake of fiber in preschool children may also be of concern. Which one of these foods provides the best source of fiber?	Milk	6.1
	Eggs	33.3
	Orange	**60.6**
	Sausage	0
Preschool-aged children require about 500-800 milligrams of calcium per day. Which of these foods are good sources of calcium?	Watermelon	97.0
	Non-fat milk	**90.9**
	Chicken	93.9
	Cantaloupe	90.9
	Provolone cheese	**97.0**
High intakes of sodium in preschool children are of concern. Which of these foods are high in sodium?	**Instant pudding**	**36.4**
	Ham	**93.9**
	Reduced-fat yogurt	93.9
	Canned ravioli	**100.0**
Lean sources of dietary protein are recommended for preschool-aged children. Which one of these foods is a lean or low-fat source of protein?	Bologna	0
	Fish sticks	6.1
	Hot dog	0
	Tuna	**90.9**
	Chicken nuggets	3.0
Potassium is a particular nutrient of concern for preschool children. Which one of these foods provides the best source of potassium?	White bread	3.0
	Chicken breast	3.0
	Apple	36.4
	Baked potato	**57.6**
It is recommended that most of the fats in the diet of preschool children come from monounsaturated and polyunsaturated fats. Which one of these foods provides the best source of monounsaturated and polyunsaturated fats?	**Chopped walnuts**	**54.5**
	Whole milk	18.2
	Biscuit	9.1
	Cheddar cheese	18.2
Which of these foods are good protein sources?	**Lentils or other dried beans**	**100.0**
	Fruit	93.9
	Potatoes	87.9
	Fish	**97.0**

Vita

Sarah White was born in Maryville, TN on September 7, 1986. She was raised in Maryville and went to Sam Houston and Foothills Elementary School. She attended Maryville High School where she graduated in 2005. From there she went to the University of Tennessee, Knoxville where she received a Bachelor of Science in Human Ecology in 2009.

Sarah is currently pursuing a Master's of Science in Nutrition at the University of Tennessee, Knoxville.